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Dynamic Governance Innovation

Elizabeth Burleson
Pace Law School, B@burlesoninstitute.org

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by

Elizabeth Burleson*

Abstract: This article frames environmentally sound innovation in the context of transnational network theory with the goal of setting forth a preliminary framework for international legal policy coherence. I consider how network dynamics can facilitate broad diffusion of environmentally sound technologies, concluding that what appears to be fragmented trade, environment, and human rights regimes are indeed sustainable development building blocks with which to achieve dynamic governance. Collaborative environmentally sound innovation networking may be able to shepherd whole renewable energy sectors across the innovation valley of death and help turn a global responsibility to ramp up green technology into a global initiative to do so.

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I. Introduction

Dynamic network governance can help coordinate interdisciplinary, inter-sectoral, and transboundary cooperation to balance the protection of property rights with access to environmentally sound, socially sensitive technology innovations. In particular, networks can consider policy coherence (sensible coordination and integration) among human

* Professor Elizabeth Burleson has a LL.M. from the London School of Economics and Political Science and a J.D. from the University of Connecticut School of Law. She teaches Energy Law, Property Law, and Human Rights and the Environment at Pace Law School.

rights, environmental and economic arenas. International institutions are often networks in their own right and have the capacity to bring stakeholders together to address governance gaps and conflicts. For instance, closing the climate mitigation gap in an affordable, environmentally sound way likely involves coordinating strategies among mitigation, adaptation, development, and disaster risk reduction in a manner that is mutually reinforcing.

The open question is how green technology networking can play a role in innovation and diffusion to address climate change. Knowledge sharing can help realize co-benefits from addressing climate and human security. In the new geography of technology governance, the International Energy Association warns that in the energy efficiency sector, "significant underinvestment remains, resulting from an array of market financial, information, institutional and technical barriers."[1] Reducing trade barriers against energy-efficient and renewable technologies can be a strategic means of closing the climate mitigation gap.[2] At the same time, innovation-centric networking remains a critical and still under-theorized area of scholarship. My central thesis is that networks can play a catalytic role in coordinating environmentally sound technology innovation and diffusion.

In Section II, I set out the theoretical underpinnings of my analysis through a law and economics frame of transnational network theory applied to address environmentally sound technology (EST) market failures.

Section III of this Article analyzes three legal approaches to addressing EST market failure: (1) a freestanding instrument, (2) WTO jurisprudence regarding infant renewable industry subsidies, and (3) climate technology network coordination. This Article recommends that transnational intra-network policy coordination can help map economic, social, and environmental gaps and conflicts. Moreover, networks can help

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[1] OECD/IEA 2011 CLEAN ENERGY PROGRESS REPORT, OECD and IEA, *available at* http://iea.org/Textbase/npsum/CEM_Progress_ReportSUM.pdf. *See also* UNITED NATIONS SECRETARY-GENERAL'S HIGH-LEVEL PANEL ON GLOBAL SUSTAINABILITY, RESILIENT PEOPLE RESILIENT PLANET: A FUTURE WORTH CHOOSING 4 (2011) *available at* http://www.un.org/gsp/sites/default/files/attachments/GSPReportOverview_Letter%20size.pdf. (noting that drivers include "unsustainable lifestyles, production and consumption patterns and the impact of population growth. As the global population grows from 7 billion to almost 9 billion by 2040, and the number of middle-class consumers increases by 3 billion over the next 20 years, the demand for resources will rise exponentially. By 2030, the world will need at least 50 per cent more food, 45 per cent more energy and 30 per cent more water — all at a time when environmental boundaries are throwing up new limits to supply.") *Id*. S*ee also* Mark Muro, Letha Tawney and Alex Trembeth, BEYOND BOOM AND BUST: GETTING CLEAN ENERGY POLICY RIGHT, THE BROOKINGS INSTITUTION (2012) *available at* http://www.brookings.edu/~/media/Files/rc/papers/2012/0418_clean_investments/0418_clean_investments_final%20paper_PDF.pdf ("In the absence of significant and timely energy policy reform, the recent boom in US clean tech sectors could falter.") *Id.*

[2] The IPCC indicates that atmospheric CO2 levels were above 390 ppm (39% beyond preindustrial concentrations) at the close of 2010, *see* ZERO ORDER DRAFT SPECIAL REPORT RENEWABLE ENERGY SOURCES (SRREN) SUMMARY FOR POLICYMAKERS 3 (2011) IPCC, *available at* http://srren.ipcc-wg3.de/report/srren-spm-fd4 (Renewable energy can "contribute to social and economic development, energy access, a secure energy supply, and reducing negative impacts on the environment and health.") *Id.*

coordinate policy coherence on such challenges as public support for infant renewable innovation and diffusion consistent with fair trade. Environmentally sound innovation and diffusion could benefit from both innovation networking and a freestanding instrument that coordinates trade, intellectual property, environmental, and human rights law.

The new Climate Technology Center and Network can go beyond the capacity of international economic law by coordinating public-private breakout EST cooperation. Leadership in Energy and Environmental Design (LEED) Certification for green building provides a private certification catalytic approach with which to nest networks within networks to share best practices for environmentally sound innovation and diffusion. Section IV makes the case for EST innovation and diffusion to least developed countries.

Economic network effects can enhance EST innovation. The nascent technology network can help coordinate a reciprocal trade-environment measure that clarifies trade regime support. In particular, the technology network can be catalytic in incentivizing environmentally sound energy innovation and diffusion to least developed countries.

In this Article, I offer a theory on how to move closer to international cooperation through transnational network coordination. Intra-network coordination at the local, national, and international levels can help clarify challenges and build consensus on policy responses. In doing so, I provide a preliminary approach moving away from international legal fragmentation to policy coherence on environmentally sound innovation and diffusion.

II. Law and Economics: Transnational Network Theory

In order to develop my central thesis that networks can play a catalytic role in coordinating environmentally sound technology innovation and diffusion, I first set out the theoretical underpinnings of my analysis.

A. Methodology

This Article applies the economic network effects theory to environmentally sound innovation sharing. In doing so, it draws upon the literature of good governance theory, trade, sustainability, adaptive management, intersystemic governance, transgovernmental networks, the dynamic school and multiscalar governance networks.[3] These interrelated governance theories are woven together with economic game theory

[3] *e.g.* J.B. RUHL, CLIMATE CHANGE ADAPTATION AND THE STRUCTURAL TRANSFORMATION OF ENVIRONMENTAL LAW 363, *available at* http://biotech.law.lsu.edu/climate/docs/ssrn-id1517374.pdf ("Transgovernmental Network theory emphasizes the nonhierarchical horizontal and vertical networks that are built among the officials of those national and international institutions to exchange information, identify best practices, harmonize approaches, and enforce the overall international policy program. The movement toward Dynamic Federalism and New Governance at domestic, federal and state scales portends the same conditions that are giving rise to such networks in international contexts.") *Id.* at 363.

and climate collective action.[4] I rely upon synergies among competing rights frames. These include intellectual property rights, human rights, and environmental sustainability.

I analyze optimal scales of regulation, often called matching in the US and tied to the related notion of subsidiarity in Europe. Mindful of global legal pluralism, I argue that innovation cooperation can build upon lessons learned from property law with regard to intellectual property rights and the closing of commons. This analysis draws upon the observations of Coase, Nash, Sen, Dworkin, Ostrom, and Sax in its exploration of normative law and economics. It also draws upon Koh, Janis, and the London School of Economics tradition of bridging economic theory and progressive international legal reform.[5]

B. Network Theory

Public-private network coordination can enhance the sharing of renewable energy and efficiency solutions. A body of economic "network effect" literature has built upon Michael Katz and Carl Shapiro 's work on the ramping up of dominant standards via network activity.[6] Collaborative public sector and non-governmental organization networks, when representative and transparent, can increase in stature and legitimacy through their involvement in inclusive decision-making.

While "private power is still no substitute for state power," NGO networks can shape policy discourse by proposing recommendations and frameworks. In this context, Reiser and Kelly have highlighted the need for NGO accountability to ensure international legal legitimacy.[7] A decision-making process increases in stature and legitimacy when it involves representative, transparent, non-governmental networks that are able to flesh out frameworks. The downside is that such inclusive decision-making can take more time and require more resources than decision-making that is less inclusive.

Cho and Kelly argue that the power of "networks results from the intra-network dynamics they foster and the end products that they develop."[8] Recognizing networks as

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[4] *c.f.* Mark Dawson, *Three Waves of New Governance in the European Union*, E.L. REV. 2011, 36(2), 208-225, 210 (2011) ("We have legal effects (governance) but not legal responsibility (a set of rules or actors that can be checked to see if, in fact, the correct plan of action is being carried out") *Id.*

[5] Harold Koh, *The American Tradition of International Law Great Expectations* 1789-1914, 21 Conn. J. Int'l L. 191, 191 (2006) (highlighting the universalist international law scholarship of Mark W. Janis as the United States leans away from international legal solutions to pressing global problems. Koh explains that "[t]he American universalist tradition represents a commitment to fundamental justice, international legal process, transnationalism, and human rights. It can be contrasted to positivism, which views international law not as natural law, but as a construct of manmade law. . . "); *see e.g.* Mark W. Janis, *Individuals as Subjects of International Law*, 17 CORNELL INT'L L.J. 61 (1984) (Discussing treaties with non-state actors).

[6] Michael L. Katz and Carl Shapiro, *Network Externalities, Competition, and Compatibility*, 75 AM. ECON. REV. 424, 424 (1985).

[7] *see* Dana Brakman Reiser and Claire R. Kelly, *Linking NGO Accountability and the Legitimacy of Global Governance*, 36 BROOKLYN J. INTL. L. 1001, 1014-15 (2011).

[8] Sungjoon Cho and Claire R. Kelly, PROMISES AND PERILS OF NEW GLOBAL GOVERNANCE: A CASE OF THE G20, 12 CHI. J. INT'L L. 491, 505 (2012).

processes, Cho and Kelly argue that G20 financial crisis coordination provides a transgovernmental regulatory network model for timely regulatory response.[9] While the jury may still be out on that, a more general proposition is that network-generated norms[10] can sometimes lessen decision-making inertia. Yet, when collaborative governance involves civil society networks in inclusive decision-making, it is important to be mindful of legitimacy (both of the overall governance approach and of given civil society network participants.)

Governments that are representative are generally seen as more legitimate than those that are not. Non-governmental entities may be more representative than their governments in some contexts and less so in others. Irrespective of the degree to which governments model good governance, non-state actor networks that seek involvement in decision-making should maximize good governance principles.[11] By doing so such non-governmental entities can better facilitate policy coordination because their own policy generation process will be less likely to be scrutinized on procedural grounds. This collaboration then leaves an open space with which to find common ground on substantive concerns that have brought these entities together. Stakeholders may all want the same outcome – a stable climate but also have distinct and at times seemingly irreconcilable interests that can be seen as too reliant upon market forces or, in contrast, too reliant upon a well-resourced public sector. Similarly, distrust arises when plans appear paternalistic or colonial. Technological complexity may not match local community capacity, but developing country communities are adept at such analyses because knowledge is shared in a culturally sensitive manner.

Civil society is not by definition legitimate or illegitimate in the context of network norm generation. Networks themselves are neither innately good nor bad. They can be useful in coordinating complex international cooperation or work to oversimplify policy coherence in a direction favoring a vested interest.[12]

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[9] *See generally* Anne-Marie Slaughter, *A New World Order* (Princeton 2004) (discussing norm-building by government networks); *see also* David Zaring, *Rulemaking and Adjudication in International Law*, 46 COLUM. J. TRANSNATL. L. 563, 576 (2008) (discussing the role of networks in international administrative law); *see also* Cho and Kelly, *supra* note 8 at 491, (discussing the role of the G20 as a transgovernmental regulatory networks (TRNs) in the context of the financial crisis) citing Peter M. Haas, *Introduction: Epistemic Communities and International Policy Coordination*, 46 INTL. ORG. 1, 2 (1992) and Keohane and Joseph Nye, *Transgovernmental Relations and International Organizations*, 27 WORLD. POL. 39, 61 (1974); *see also* INECE, CHAPTER TWELVE, TRANSGOVERNMENTAL NETWORKS 384, *available at* http://inece.org/mlw/Chapter12_TransgovernmentalNetworks.pdf.

[10] *c.f.* Pierre-Hugues Verdier, *Transnational Regulatory Networks and Their Limits*, 34 YALE J. INTL. L. 113, 114 (2009) ("In recent years, scholars of global governance have devoted substantial attention to the promise and perils of... regulatory networks (TRNs).") *Id.*

[11] UNITED NATIONS ECONOMIC AND SOCIAL COMMISSION FOR ASIA AND THE PACIFIC, HUMAN SETTLEMENTS, WHAT IS GOOD GOVERNANCE? *available at* http://www.unescap.org/huset/gg/governance.htm.

[12] Cho and Kelly, *supra* note 8 at 507-508 (When shared vision, trust and complementary expertise can overcome gridlock to act collectively, valuable advice and mediation capacity can be gained through working within nested networks. At worst networks may engage in coercion. The dynamics at play in a given intra-network engagement can affect the effectiveness and perceived legitimacy of the process. Who should be at the table? International innovation

Principle 10 of the Rio Declaration calls for greater public participation in environmental decision-making.[13] This principle has been codified in the Aarhus Convention Human Right to a Clean Environment and network norm generating initiatives to expand the principle to a global, or at least series of regionally binding instruments, are underway – most recently in the context of Rio+20.[14] Consequently, access to information, public participation, and access to justice are gaining widespread credence as core aspects of good governance.[15] In the context of EST innovation and diffusion, interactions between transnational (private) networks and transgovernmental (public) regulatory networks include dynamic climate negotiation participation in which private networks act as counterparts to public networks in government, international institution, and non-state actor network interactions. Network-generated norms[16] ebb and flow in such inter-active forums as the climate negotiations and can alternately exacerbate gridlock and create openings for break out consensus building.

Even when networks consist of public civil servants rather than non-state actors, legitimacy questions still arise with regard to whether there is a need for elected officials.[17] If representation involves actually reflecting a pluralistic international community, then broad involvement of a wide array of stakeholders arguably provides a model for EST governance.

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cooperation can involve research/ education institutions, companies, international institutions, governments, and NGOs. Given this array of stakeholders, network generated rules, norms, and standards may end up representing best practice prototypes or a race to the bottom proposals. Public sector capacity should be robust enough to weigh competing guidance from non-state actor networks.)

[13] Rio Declaration Principle 10 (1992) *available at http://www.unep.org/Documents.Multilingual/Default.asp?documentid=78&articleid=1163 (*Principle 10 states that "Environmental issues are best handled with participation of all concerned citizens, at the relevant level. At the national level, each individual shall have appropriate access to information concerning the environment that is held by public authorities, including information on hazardous materials and activities

In their communities, and the opportunity to participate in decision-making processes. States shall facilitate and encourage public awareness and participation by making information widely available. Effective access to judicial and administrative proceedings, including redress and remedy, shall be provided.") *Id.*

[14] Rio on Principle 10 *supra* note 13; *see also CIEL Submission to Rio+20* (2011), CIEL *available at* http://www.uncsd2012.org/rio20/content/documents/567CIEL%20rio%202012%20comments.pdf ("One particular sectoral element of the green economy that Rio+20 could consider is the use of technology to promote innovation in the developed world . . . Rio+20 could contribute to the beneficial use of technologies for sustainable development by identifying and supporting options beyond intellectual property rights to spur innovation.") *Id.*

[15] e. g. Oliver A. Houck, TAKING BACK EDEN: EIGHT ENVIRONMENTAL CASES THAT CHANGED THE WORLD (Island Press: 2010).

[16] *See* Margaret Chon, *PPPs in Global IP* (*Forthcoming*) manuscript on file with author (discussing normative plasticity in NGO driven PPP network processes.); *c.f.* Verdier, *supra* note 10.

[17] Cho and Kelly, *supra* note 8 at 557.

C. Bringing Climate Technology Networking Into Focus

UNFCCC Technology Mechanism coordination does not innately confer legitimacy but lends credence to the working of a broad intra-network EST initiative. That said, the emerging technology mechanism is vulnerable to capture. Consequently, the international community should prioritize defining "environmentally sound" technology based, for instance, on the Agenda 21 Chapter 34 definition:

> Environmentally sound technologies protect the environment, are less polluting, use all resources in a more sustainable manner, recycle more of their wastes and products, and handle residual wastes in a more acceptable manner than the technologies for which they were substitutes.[18]

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[18] U.N. Dep't of Econ. & Soc. Affairs Div. for Sustainable Dev., AGENDA 21: Earth Summit–The United Nations Programme of Action from Rio (Apr. 1993), *available at* http://www.un.org/esa/ sustdev/documents/agenda21/english/agenda21chapter34.htm.

Agenda 21, Chapter 34 on Transfer of Environmentally Sound Technology, Cooperation and Capacity-Building also states:

> 34.2. Environmentally sound technologies in the context of pollution are "process and product technologies" that generate low or no waste, for the prevention of pollution. They also cover "end of the pipe" technologies for treatment of pollution after it has been generated.
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> 34.3. Environmentally sound technologies are not just individual technologies, but total systems which include know-how, procedures, goods and services, and equipment as well as organizational and managerial procedures. This implies that when discussing transfer of technologies, the human resource development and local capacity-building aspects of technology choices, including gender-relevant aspects, should also be addressed. Environmentally sound technologies should be compatible with nationally determined socio-economic, cultural and environmental priorities.
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> 34.4. There is a need for favourable access to and transfer of environmentally sound technologies, in particular to developing countries, through supportive measures that promote technology cooperation and that should enable transfer of necessary technological know-how as well as building up of economic, technical, and managerial capabilities for the efficient use and further development of transferred technology. Technology cooperation involves joint efforts by enterprises and Governments, both suppliers of technology and its recipients. Therefore, such cooperation entails an iterative process involving government, the private sector, and research and development facilities to ensure the best possible results from transfer of technology. Successful long-term partnerships in technology cooperation necessarily require continuing systematic training and capacity-building at all levels over an extended period of time.
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> 34.5. The activities proposed in this chapter aim at improving conditions and processes on information, access to and transfer of technology (including the state-of-the-art technology and related know-how), in particular to developing countries, as well as on capacity-building and cooperative arrangements and partnerships in the field of technology, in order to promote sustainable development. New and efficient technologies will be essential to increase the capabilities, in particular of developing countries, to achieve sustainable development, sustain the world's economy, protect the environment, and alleviate

The new UNFCCC Technology Mechanism should establish a clear definition of "environmentally sound," as well as technology assessment criteria mindful of science and equity.[19] These definitions would provide a starting point which would begin to balance economic, social and environmental sustainability principles within technology governance generally and climate mitigation/adaptation in particular.

1. Taking Stock of Environmentally Sound Innovation Network Coordination

In 2010, the Cancún Agreements encompassed a climate breakthrough on technology transfer – freeing innovation from the bargaining chip status that it had acquired in the negotiating process to obtain binding greenhouse gas (GHG) emissions reduction targets. The new Technology Mechanism provides an opportunity to coordinate implementation of commitments set forth two decades ago in the United Nations Framework Convention on Climate Change (UNFCCC)[20] and, more recently, in the Agreement on Trade-Related Aspects of Intellectual Property (TRIPS).[21] The Mechanism also is an opportunity to prioritize environmentally sound innovation sharing to least developed countries.[22]

Article 4(5) of the UNFCCC calls for nations to transfer environmentally sound technology.[23] Likewise, Article 66 of Trade-Related Aspects of Intellectual Property Rights (TRIPS) requires developed member nations to help facilitate technology transfer

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> poverty and human suffering. Inherent in these activities is the need to address the improvement of technology currently used and its replacement, when appropriate, with more accessible and more environmentally sound technology.

[19] Criteria can include consideration of public health and cultural context; ecosystem protection; life-cycle analysis; and minimization of non-renewable energy.

[20] U.N. Framework Convention on Climate Change, May 9, 1992, 31 I.L.M. 849 (1992), *available at* http://unfccc.int/resource/docs/convkp/conveng.pdf [hereinafter UNFCCC]. One hundred sixty-five countries ratified the UNFCCC. *Id.* The convention entered into force on March 21, 1994. *Id.*

[21] *See* Agreement on Trade-Related Aspects of Intellectual Property Rights, Apr. 15, 1994, 33 I.L.M. 1197 (1994) [hereinafter TRIPS]; *see also* DANIEL GERVAIS, THE TRIPS AGREEMENT: DRAFTING HISTORY AND ANALYSIS 27 (2d ed. 2003) (explaining the adoption and implementation of TRIPS).

[22] UNFCCC/CP/2007/6/Add.1, Decision 1/CP.13., para. 1(d).

[23] Article 4(5) of the Framework Convention on Climate Change states:

> The developed country Parties and other developed Parties included in Annex II shall take all practicable steps to promote, facilitate and finance, as appropriate, the transfer of, or access to, environmentally sound technologies and know-how to other Parties, particularly developing country Parties, to enable them to implement the provisions of the Convention. In this process, the developed country Parties shall support the development and enhancement of endogenous capacities and technologies of developing country Parties. Other Parties and organizations in a position to do so may also assist in facilitating the transfer of such technologies.

UNFCCC *supra* note 20.

to least-developed countries and gives such countries greater latitude concerning the agreement.[24]

Given this legal base, international environmental law and international economic legal institutions can coordinate effective efforts to cap and reduce greenhouse gas emissions in a reasonable and equitable manner.

Environmentally sound technology transfer requires a careful balancing act that includes both fair treatment for innovators and energy policies that stimulate global diffusion of environmentally sound technology to address climate change. Countries can remove export restrictions on environmentally sound technologies and facilitate their export through tax relief/rebates for income or sales taxes.[25] Such incentives can be achieved in a manner consistent with supporting international trade.[26] The law is unsettled regarding the degree to which environmentally sound technology transfer initiatives conflict with such regulations as the Agreement on Subsidies and Countervailing Measures of the World Trade Organization. International environmental law and international economic law have important core objectives that need not be mutually exclusive. This tension is at the crux of sustainable development.

The UNFCCC calls upon developed parties to take all practicable steps to promote, facilitate, and finance transfer/access of environmentally sound technologies and know-how to developing countries.[27] The legal duty lies with developed state parties to the framework convention. In contrast to TRIPS, the UNFCCC broadens the obligation from least developed countries to a broader range of developing countries.[28] The

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[24] Article 66 of Trade-Related Aspects of Intellectual Property Rights (TRIPS) states that:

> In view of the special needs and requirements of least-developed country Members, their economic, financial and administrative constraints, and their need for flexibility to create a viable technological base, such Members shall not be required to apply the provisions of this Agreement, other than Articles 3, 4 and 5, for a period of 10 years from the date of application as defined under paragraph 1 of Article 65. The Council for TRIPS shall, upon duly motivated request by a least-developed country Member, accord extensions of this period. Developed country Members shall provide incentives to enterprises and institutions in their territories for the purpose of promoting and encouraging technology transfer to least-developed country Members in order to enable them to create a sound and viable technological base.

Agreement on Trade-Related Aspects of Intellectual Property Rights pt. 4, art. 66, § 12, Apr. 15, 1994, 33 I.L.R. 1197, *available at* http://www.wto.org/english/tratop_e/trips_e/t_agm7_e.htm.

[25] Gaetan Verhoosel, *Beyond the Unsustainable Rhetoric of Sustainable Development: Transferring Environmentally Sound Technologies*, 11 GEO. INT'L ENVTL. L. REV. 49, 71 (1998).

[26] *See*, *e.g.*, Agreement on Subsidies and Countervailing Measures (ASCM), Marrakesh Agreement Establishing the World Trade Organization Annex 1A, Apr. 15, 1994, 33 I.L.M. 229.

[27] UNFCCC Article 4.5 *supra* note 20.

[28] *See* Juan Antonio Duro, *On the Automatic Application of Inequality Indexes in the Analysis of the International Distribution of Environmental Indicators,* ECOLOGICAL ECONOMICS 76 (2012) 1-7, *available at* www.elsevier.com/locate/ecolecon (discussing the "study of the international distributive dimension of different environmental indicators such as C02.") *Id.* at 1; *see also* MATTHIAS MEYER, LDCS' TRADE AND INVESTMENT CHALLENGES (2011), *available at* http://ictsd.org/downloads/2010/11/ldcs-trade-and-investment-challenges.pdf ("Not all LDCs have the same opportunities and constraints to develop: a majority are medium-size countries with a small export base. Some have started to diversify into agro- processing and manufacturing,

UNFCCC also requires developed countries to "promote, facilitate and finance" technology transfer. Further, this UNFCCC obligation to transfer technology encompasses not only a physical transfer of equipment but also know-how. Much ink has been spilt and trees felled to produce climate outcome language. "Capacity building" has been a consistent but low profile thread running through the climate consensus building process. I will explore the contours of this ill-defined notion called capacity building. It follows technology transfer as the next faze out of well-seasoned climate negotiators' mouths and can be found attached to most UNFCCC and secondary literature regarding technology transfer. Collectively, member states to the UNFCCC have outlined the role of the Technology Mechanism host as requiring the following characteristics of network leadership: "capability, experience, knowledge, expertise, financial strength and capacity to perform the specified activities."[29] With this new innovation centric forum, greater collaboration can bridge the treaty language / implementation challenge.

2. Why Cooperate at the International Level? Energy-Climate Market Failure

Stephen Humphreys argues that it is likely to be "unproductive today to approach technology transfer as a simple matter of rights and duties. Technology policy will only succeed if based on international cooperation."[30] While not universal, there is broad

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others into mining or modern services. Six oil producers are among the LDCs as well as a group of vulnerable small islands. Finally, a number of LDCs are in the throngs of civil strife and unresolved statehood.") *Id.*

[29] UNFCCC, CALL FOR PROPOSALS TO HOST THE TECHNOLOGY MECHANISM 2 (2012), http://unfccc.int/files/cooperation_and_support/technology/application/pdf/cfp_2012-s1_climate_technology_centre_print.pdf (Annex 1 states the Terms of reference of the Climate Technology Centre and Network Mission as: "The mission of the Climate Technology Centre and Network is to stimulate technology cooperation and to enhance the development and transfer of technologies and to assist developing country Parties at their request, consistent with their respective capabilities and national circumstances and priorities, in order to build or strengthen their capacity to identify technology needs, to facilitate the preparation and implementation of technology projects and strategies taking into account gender considerations to support action on mitigation and adaptation and enhance low emissions and climate-resilient development.") *Id.* at 5.

[30] Stephen Humphreys, BEYOND TECHNOLOGY TRANSFER: PROTECTING HUMAN RIGHTS IN A CLIMATE-CONSTRAINED WORLD xv (2011), INTERNATIONAL COUNCIL ON HUMAN RIGHTS POLICY, *available at* http://www.ichrp.org/files/reports/65/138_ichrp_climate_tech_transfer_report.pdf. (this report was drafted by Stephen Humphreys, Lecturer in Law at the London School of Economics based on original research undertaken in 2009 and 2010 commissioned by the ICHRP and the following six papers: John Barton, Stanford University, Future Climate Technology Regimes: An Assessment of the Macro- Environmental Context from a Human Rights Perspective; Simon Caney, University of Oxford, Climate Technology Transfer: A Derivation of Rights- and Duties-Bearers from Fundamental Human Rights; Marcos Orellana and Dalindyebo Shabalala, Technology transfer in the UNFCCC and Other International Legal Regimes: The Challenge of Systemic Integration – CEIL; Sisule Musungu, IQSensato, Health: Human Rights, Climate Vulnerability and Access to Technology; María Julia Oliva, Union for Ethical Biotrade; Promoting the Transfer of Technologies for Adaptation in Agriculture: A Role for the Right to

agreement that not responding to climate change will be catastrophic for frontline least developed countries that have contributed the least GHG emissions. Humphreys explores how the human rights framework provides both a legal and ethical foundation upon which to advance technology transfer cooperation.[31] In particular, least developed countries need technology transfer to adapt to climate change impacts and to sustain environmentally sound community development.

Through both trade and environmental treaty commitments, the international community has recognized state responsibility to transfer technology to least developed states. Elsewhere I have explored TRIPS and UNFCCC treaty obligations[32] and here I focus on the manner in which environmentally sound innovation and diffusion can best be facilitated through law. The near universal nature of UNFCCC and TRIPS ratification by states supports the argument that international dedication to sharing environmentally sound technology with least developed countries is both longstanding and represents "hard," binding law. Yet, dedication might not be the way the average observer would describe the degree of technology that has been transferred to date. "Embryonic" or "nascent" might be terms that better describe the lack of urgency to broadly diffuse climate friendly technologies to frontline communities.

Since the 2010 climate conference in Cancún, there has been a clear mandate to approach technology transfer cooperation in a manner that embraces human rights. The Cancún Agreements reached a milestone in the UNFCCC climate negotiations by explicitly recognizing the need to "fully respect human rights" in "all climate change-related actions." [33] Human rights law can help provide a framework for innovation and diffusion, especially with respect to energy siting decisions and human/environmental impact assessments. Elsewhere, I have explored the role of such procedural human rights as access to information and public participation with regard to energy siting.[34] Here I

Food; and Sivan Kartha, Clarisse Kehler Siebert and Richard Klein, Technology Policies to Support Adaptation in Developing Countries: Equity and Rights Considerations – Stockholm Environmental Institute.)

[31] *Id.*

[32] *See generally* Elizabeth Burleson and Winslow Burleson, *Innovation Cooperation: Energy Biosciences and Law*, 2011 U. ILL. L. REV. 651 (2011); *see also* Elizabeth Burleson, *Energy Policy, Intellectual Property and Technology Transfer to Address Climate Change*," 18 TRANSNAT'L L. & CONTEMP. PROBS. 69 (2009); *see also* Elizabeth Burleson, *Climate Change Consensus: Emerging International Law*, 34 WM. & MARY ENVTL. L. & POL'Y REV. 543 (2010).

[33] "Outcome of the work of the Ad Hoc Working Group on long-term Cooperative Action under the Convention" (United Nations Framework Convention on Climate Change Secretariat, December 12, 2010), chapter IVB, http://unfccc.int/files/meetings/cop_16/application/pdf/cop16_lca.pdf.

[34] Elizabeth Burleson, *Emerging Law Addressing Climate Change and Water*, 5 ENVTL. & ENERGY L. & POL'Y J. 489 (2010); *see also* Elizabeth Burleson, *Cooperative Federalism and Hydraulic Fracturing*, _ CORNELL JOURNAL OF LAW AND PUBLIC POLICY _ (2013) *forthcoming; see also* Elizabeth Burleson and Stephanie Dodson Dougherty, *Arctic Justice: Addressing Persistent Organic Pollutants*, 30 LAW AND INEQUALITY 57 (2012); *see also* Elizabeth Burleson, *The Polar Regions and Environmental Law*, *in* ROUTLEDGE HANDBOOK OF INTERNATIONAL ENVIRONMENTAL LAW (Shawkat Alam, Jahid Hossain Bhuiyan, Tareg M.R. Chowdhury & Erika Techera eds., 2012); *see also* Elizabeth Burleson, *Multilateral Climate Change Mitigation*, 41 U.S.F. L. REV. 373 (2007).

explore how technology transfer can involve cooperation on both ends to meet not only local geographical but also substantive human rights considerations. Law can both foster and inhibit technology transfer. As a result, it is difficult to optimize transboundary coordination that is mindful of state capacity to balance incentives to innovate with access to public goods.

In genuinely efficient markets, prices reflect natural resource scarcity value.[35] Where market failure occurs, the OECD argues that prioritizing research, development, innovation, education and information should go hand in hand with balancing investment *vis a vis* public interests. In the context of socio-environmental security and resilience, the OECD findings suggest that increasing human capital can enhance the benefits of shared innovation.[36] People in the Global South can absorb and adapt technology to suit local conditions. Technology networking can help internalize the negative externality of GHG emissions through environmentally sound innovation sharing.

Climate is a public good that requires the development of an energy strategy based upon international cooperation, energy efficiency, and sustainable development. Process and outcome are integral to addressing water, climate, and energy challenges. Regulation ought not outweigh the harm that it seeks to address and regulatory innovation should incentivize technological innovation to enhance social welfare.[37] Energy innovation has public good characteristics that Hardin[38] and Ostrom[39] have highlighted in their work on commons and that has led to an extensive body of literature on how to coordinate public-private commons, semi-commons, and anti-commons access. Irrespective of one's views justifying resorting to property rights, doing so opens an array of instruments with which to influence behavior. An important question is how public sector policies regarding intellectual property, trade, environmental regulation, tax code options to name a few can coordinate economic, equity and environmental objectives.

If global demand for energy doubles by 2030,[40] transitioning to renewables and efficiency will be that much more challenging than if business as usual projections were

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[35] OECD SECRETARIAT: INPUTS TO THE RIO+20 COMPILATION DOCUMENT 5 (2011) *available at* http://www.uncsd2012.org/rio20/content/documents/234Rio20%20Compilation%20Document_OECD%20inputs%20Final.pdf.

[36] *Id.*

[37] Timothy Slating and Jay Kesan, *Making Regulatory Innovation Keep Pace With Technological Innovation,* 2011 WIS. L. REV. 1109 (2011); *see* Sarah Tran, EXPEDITING INNOVATION, 36 HARV. ENVTL. L. REV. (2012) (arguing that capturing the social value of emerging green technologies justifies adjusting patent-related regulation).

[38] Garrett Hardin, *The Tragedy of the Commons*, 162 SCIENCE 1243 (1968).

[39] *See* ELINOR OSTROM, GOVERNING THE COMMONS: THE EVOLUTION OF INSTITUTIONS FOR COLLECTIVE ACTION (1990) (encouraging resource appropriators to participate in decision-making).

[40] WIPO INPUT FOR THE COMPILATION DOCUMENT FOR THE PREPARATORY PROCESS OF THE UN CONFERENCE ON SUSTAINABLE DEVELOPMENT 2 (2011) WIPO, *available at* http://www.uncsd2012.org/rio20/content/documents/632WIPO%20Contribution%20to%20Compilation%20Document%20Rio%2020%20Final.pdf ("This shift to a new technology base requires policies that incentivize investments in the research and development of new environmentally sound technologies and which support the transfer, adaptation and widespread dissemination of

to remain constant. Yet, international norm building has been constrained by the United States' "remarkably powerful reluctance to act."[41] Consequently, vocabulary has migrated to the economic efficiency end of the spectrum. For instance, we now talk of "human capital" rather than education, and of "ecosystem services" rather than nature. Doing so is challenging given that demand for environmentally sound, climate friendly technologies comes from the need to reduce GHGs to address climate change rather than being traditionally market-driven. Existing price signals that drive market activity do not create socially optimal outcomes because the impacts of climate change are not reflected in the cost of emitting greenhouse gases. Furthermore, communities around the globe that would benefit from renewable technologies and energy efficiency innovations lack the money with which to transition to environmentally sound options.

It is helpful to know what developing countries identify as their technological needs. This signals demand criteria to potential manufacturers. Yet the crux of the problem is that this demand does not often represent a market – for lack of ability to pay for the range of environmentally sound innovations. Just as in relation to ecosystem services, there is a lack of a traditional market for many of the technologies needed by least developed countries. A market can be created by an international legal instrument if emissions of GHGs are linked to payment for climate projects in developing countries.[42] Elsewhere I explore the best practices emerging from the Regional Greenhouse Gas Initiative (RGGI), EU, and UN approaches to flexible markets for energy innovation.[43] Here I make the case for the catalytic role of environmentally sound innovation networks in coordinating international economic and environmental law and policy.

D. Uncertainty, Risk, and Life Cycle Analysis

Energy law discourse regarding transitioning to renewable and energy efficiency often stalls at the stage of addressing stranded asset charges despite the more important dilemma that the energy-water-climate nexus is central to individual, regional, and

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these technologies. A critical component of this new technology base is the need to respond to increased demand for energy.") *Id.*

[41] Jody Freeman and Andrew Guzman, CLIMATE CHANGE AND U.S. INTERESTS, 41 ENVTL. L. REP. NEWS & ANALYSIS 10695 (2011) ("To date, the primary response to the climate change winner argument has been to insist that regardless of the cost-benefit calculation, the United States is morally obligated to act either because it is the largest historic contributor to the problem (the corrective justice argument), or because it ought to help poorer nations (the distributive justice argument). Alternatively, some suggest that the United States has an ethical obligation to future generations.") *Id.* at 10696; *see also* Nigel Purvis, *The Case For Climate Protection Authority,* 49 VA. J. INT'L L. 1007 (2009) (explaining the myriad ways in which the United States is constrained in ratifying treaties.)

[42] Under the Kyoto Protocol, the Joint Implementation (between developed countries) and Clean Development Mechanism (between developed and developing countries) set up just such a market. Tons of carbon emitted by one country could be traded for renewable energy projects in another country. This cap and trade approach is underway in the EU as well.

[43] Elizabeth Burleson, *From Coase to Collaborative Property Decision-making: Green Economy Innovation*, 14 TULANE JOURNAL OF TECHNOLOGY AND INTELLECTUAL PROPERTY 79 (2011).

international security. Scientific and legal uncertainty remain challenges to networks capacity to play a catalytic role in coordinating environmentally sound technology innovation and diffusion.[44] Moreover, sustainable development is not well measured by GDP. For this reason, the IUCN offers a nature-based lens with which to assess environmentally sound decision-making.[45] Economic tools, incentives, and policies that are mindful of ecosystem services can help internalize environmental costs by accounting for such ecosystem benefits as water-energy security.[46] The World Bank explains that

> measuring green growth also requires new tools. GDP indicates whether an economy is growing, but gives no information on whether the growth is sustainable. That is why putting in place comprehensive wealth accounts that focus on the value of natural capital and ecosystem services, and integrating them into development planning is an important part of mainstreaming green growth.[47]

Broader indicator models include the UN System of Environmental and Economic Accounting.[48]

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[44] Jorge E. Vinuales, LEGAL TECHNIQUES FOR DEALING WITH SCIENTIFIC UNCERTAINTY IN ENVIRONMENTAL LAW, 43 Vand. J. Transnat'l L. 437 (2010) (Analyzing how scientific uncertainty is handled in international environmental law.)

[45] IUCN'S POSITION PAPER ON THE FRAMEWORK FOR SUSTAINABLE DEVELOPMENT 2 (2011) for the Rio 2012 Conference June 2012, IUCN, *available at* http://www.uncsd2012.org/rio20/content/documents/163iucn1.pdf (noting that "IUCN considers that an intervention is a nature-based solution if it features the following principles: i) the intervention delivers an effective solution to a major global challenge using nature; ii) it provides biodiversity benefits in terms of diverse, well-managed ecosystems; iii) it is cost effective relative to other solutions; iv) the rationale behind the intervention can be easily and compellingly communicated; v) it can be measured, verified and replicated; vi) it respects and reinforces communities' rights over natural resources; and vii) it harnesses both public and private sources of funding.") *Id.*

[46] *Id.*

[47] THE ROAD TO RIO+20 AND BEYOND 3 (2011), World Bank Group, *available at* http://www.uncsd2012.org/rio20/content/documents/582World%20Bank%20Group1.pdf(noting that "Green and inclusive growth is climate-resilient, water-smart, land-saving, energy- efficient and reliant on diverse energy sources. It also generates decent jobs and improves livelihoods across a diverse set of productive and service sectors. It is underpinned by properly valued natural capital, the value of which is fully integrated into countries' systems of national accounts. Green and inclusive growth paths factor environmental considerations into government policies and business decisions, placing sustainable natural resource management - with its benefits flowing to people - at the heart of future development and growth. The improved health of people that stems from cleaner air, land and water benefits from and feeds back into this new growth path. Gender equality when recognized as "smart economics" enhances productivity and further improves development outcomes.") *Id.* at 2.

[48] SUBMISSION OF THE NATURAL RESOURCES DEFENSE COUNCIL TO THE SECRETARIAT OF THE UNITED NATIONS CONFERENCE ON SUSTAINABLE DEVELOPMENT -"RIO+20 EARTH SUMMIT" (2011), The Natural Resources Defense Council (NRDC), *available at* http://www.uncsd2012.org/rio20/content/documents/331NRDC%20November%201%20submission%20to%20the%20UNCSD.pdf.

Nathan Mee and Marc Miller have analyzed varying approaches to calculating lifecycle costing ranging from actuarial value of a life to cost of CO_2 mitigation via natural carbon sinks. Based upon these methods, they conclude that the average marginal cost of a ton of carbon may be roughly $40 USD, but that even if it is much higher, it is prudent to join efforts such as the European cap-and-trade system.[49] Doing so can make the cost of GHG emissions apparent rather than "pushing the cost off to other places where we do not recognize it."[50] Participating in ongoing lifecycle analysis can enable states to fulfill their obligation to transfer environmentally sound technologies. In least developed countries such technology may not be replacing any previous technology. In general, however, technologies transferred would displace less environmentally sound technologies. Rather than locking in an absolute technology based standard, this approach to technology transfer can be adaptive.

Timothy Meyer observes that when bargaining power is stable, "[p]lanned renegotiation, such as may be provided by sunset provisions or framework conventions that mandate negotiations on future protocols, address [] uncertainty by forcing states back to the drawing board to consider changed or evolved circumstances."[51] Economic leaders, such as Stern, explain that addressing climate change is more efficient than not doing so. Stern calls for two percent of worldwide GDP to be invested annually in addressing climate change to protect the twenty percent of global GDP that is at risk if nothing is done.[52]

The drawbacks to this argument are distributive, both across time and distance. While the IPCC continues to gather and share evolving scientific understanding of climate impacts, by its very nature science is grounded in theories rather than facts. In the face of scientific uncertainty, the UNFCCC commits member states to proceed based upon the precautionary principle.[53] Goods and service prices do not currently reflect environmental and social costs of production and consumption. Coordination in publishing and updating comprehensive energy life cycle analyses can bring transparency to the costs and benefits of climate action. I have written on this elsewhere,[54] and will turn to good governance theory to address complexity and fragmentation in this analysis.

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[49] Nathan Mee & Marc Miller, *Here Comes The Sun: Solar Power Parity With Fossil Fuels,* 36 Wm. & Mary Envtl. L. & Pol'y Rev. 119 (2011) ("Earth's atmospheric concentrations of greenhouse gases have dramatically increased since the pre-industrial era.") *Id.*

[50] *Id.* at 151; *See generally* INTERGOVERNMENTAL PANEL ON CLIMATE CHANGE WORKING GROUP III ON MITIGATING CLIMATE CHANGE, SPECIAL REPORT ON RENEWABLE ENERGY SOURCES AND CLIMATE CHANGE MITIGATION (2012) *available at* http://srren.ipcc-wg3.de/report/IPCC_SRREN_Full_Report.pdf.

[51] *See* Timothy Meyer, POWER, EXIT COSTS, AND RENEGOTIATION IN INTERNATIONAL LAW, 51 HARV. INT'L L.J. 379, 388 (2010) (discussing bargaining power in entering and exiting international instruments).

[52] Juliette Jowit and Patrick Wintour, *Cost of Tackling Global Climate Change has Doubled, Warns Stern*, GUARDIAN, June 25, 2008, *available at* http://www.guardian.co.uk/environment/2008/jun/26/climatechange.scienceofclimatechange (Lord Stern explains that "[t]o get below 500ppm ... would cost around 2% of GDP.") *Id.*

[53] UNFCCC Article 3 *supra* note 20.

[54] Elizabeth Burleson, *From Coase to Collaborative Property Decision-making, supra* note 43 at 79.

The next section will consider the role of networks in environmentally sound technology governance.

III. Environmentally Sound Innovation Sharing Via Network Coordination

Operationalizing sustainability involves public sector incentives that will aid in the transition to environmentally sound climate mitigation/adaptation innovations. Prioritizing environmental and social dynamics in economic decisions can help move the conversation from treaty language to measurable implementation.[55] The Secretary General of the UN suggests that "making explicit the economic, social and environmental costs of action and inaction; recognizing the importance of innovation, new technologies, international cooperation and investments"[56] can help shift the paradigm. I argue that a catalytic approach involves global North/South coordination on climate-energy technological, financial and capacity building cooperation.

A. Prioritizing Human Rights and Environmental Public Goods

Integrating best practices from human rights and environmental law can provide a synergistic catalyst for addressing climate change by mitigating, adapting, funding, and transferring environmentally sound innovations.

Solutions to climate instability involve (1) reducing GHGs, (2) adapting to inevitable changes, (3) funding this adaptation and mitigation, and (4) sharing environmentally sound innovations. These innovations can be both technological and legal.[57] This analysis considers ways in which human rights and environmental best practices can synergistically mitigate, adapt, fund, and share innovations in an efficient and equitable manner. It will do so by drawing upon successful good governance models from international and comparative law.

Efforts are underway to broaden Aarhus procedural rights to a clean environment beyond the European context and fully implement Principle 10 of the Rio Declaration globally. In the interim, the pertinent developed states in a position to transfer technology have largely ratified the Aarhus Convention.[58] Taking a human rights frame can foster

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[55] UN SECRETARY-GENERAL, *supra* note 1 at 5 (The UN Secretary-General's High-Level Panel on Global Sustainability observes that policy coherence can help the Brundtland report's sustainable development pillars (1) economic growth, (2) social equality and (3) environmental sustainability move from theory to practice.)

[56] *Id.*

[57] *See generally* Elizabeth Burleson, *Energy Policy, Intellectual Property and Technology Transfer to Address Climate Change*, *supra* note 32; *see also* Elizabeth Burleson, *Climate Change Consensus: Emerging International Law*, *supra* note 32.

[58] Both energy siting decisions in the field and international technology decision making at various international law gatherings should implement human rights best practices: including access to information, public participation, and justice as set forth in the Aarhus convention. *See* Convention on Access to Information, *Public Participation in Decision-Making and Access to Justice regarding Environmental Matters* (Århus Convention), June 25, 1998, 38 I.L.M. 517

international technology cooperation generally and concrete multilateral mechanisms that incentivize, fund and diffuse technology transfer.[59] For instance, reducing black carbon through innovative cook stoves and heating options has co-benefits for public health and addressing climate change.[60]

International human rights law offers a robust justice framework with which to address climate change.[61] Applying human rights thresholds to climate change can catalyze cooperative action. Decisions informed by an understanding of climate justice can bring together dialogue from development, human rights, environment, trade, and business communities. Energy-food-climate security can be discussed as the interwoven crisis that threatens humanity rather than unrelated dilemmas. The 2007 Fourth Assessment Report of the Intergovernmental Panel on Climate Change (IPCC) and subsequent studies clarify that delay in international climate consensus building threatens millions of people's resilience to climate related water scarcity, flooding, fire, and food insecurity.[62] In the Human Rights and Climate Change resolution 7/23, the U.N. Human Rights Council requested the Office of the U.N. High Commissioner to study the effects of climate change on human rights.[63] The subsequent study states "United Nations human rights treaty bodies all recognize the intrinsic link between the environment and the realization of a range of human rights, such as the right to life, to health, to food, to water, and to housing.[64] Human Rights Council resolution 10/4 on Human Rights and

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(1999) (entered into force Oct. 30, 2001), *available at* http://www.unece.org/env/pp/documents/cep43e.pdf. The convention was negotiated among the Member States of the United Nations Economic Commission for Europe (UNECE). On June 25, 1998, the convention was adopted at a pan-European meeting of environment ministers in Århus, Denmark. All of the member states of the European Union and the EU itself signed. The convention entered into force on October 30, 2001; *see also* Humphreys, *supra* note 30 at xvii.

[59] Humphreys, *supra* note 30 at xvi.

[60] Black carbon continues to compromise the international community's capacity to address climate change. Its contribution to indoor air pollution similarly makes transitioning to cleaner cooking fuels both a strong demand and supply minus the capacity to pay or bring cleaner cook stoves to scale in least developed countries. Green Building programs may be the most effective law, policy, and volunteer collaborative approach to addressing black carbon and transitioning to cleaner lighting and cooking solutions; *c.f.* Pills composed of various percentages of given chemicals requires some measurable, reportable, and verifiable quality control but are an order of magnitude more simplified in mass distribution than the range of environmentally sound technologies. As a result, reaching agreement has been harder in in the climate-energy-water context than the medical context.

[61] *See e.g.* SVITLANA KRAVCHENKO & JOHN BONINE, HUMAN RIGHTS AND THE ENVIRONMENT: CASES, LAW, AND POLICY, (Carolina University Press: 2008); *see also* Donald Anton and Dinah Shelton, ENVIRONMENTAL PROTECTION AND HUMAN RIGHTS (Cambridge University Press: 2011).

[62] CLIMATE CHANGE 2007 - SYNTHESIS REPORT, adopted at IPCC Plenary Spain, 12-17 November 2007 (IPCC AR4 Synthesis Report) at 72.

[63] OHCHR STUDY ON THE RELATIONSHIP BETWEEN CLIMATE CHANGE AND HUMAN RIGHTS (A/HRC/10/61) delivered to the tenth session of the Human Rights Council held in March 2009. http://www2.ohchr.org/english/issues/climatechange/docs/Resolution_7_23.pdf

[64] HUMAN RIGHTS COUNCIL, ANNUAL REPORT OF THE UNITED NATIONS HIGH COMMISSIONER FOR HUMAN RIGHTS AND REPORTS OF THE OFFICE OF THE HIGH

Climate Change recognizes that "effective international cooperation to enable the full, effective and sustained implementation of the United Nations Framework Convention on Climate Change … is important in order to support national efforts for the realization of human rights implicated by climate change-related impacts."[65] Discrimination can exacerbate climate vulnerable individuals and communities and impact effective public sector response measures. Recently, the Human Rights Council agreed to designate an Environment and Human Rights Expert to look at the synergies and challenges at the overlapping center of economic, social, and environmental spheres.[66]

Robinson notes that "Women's voices must be heard and their priorities supported as part of climate justice."[67] Within frontline communities, women, children,[68] and indigenous communities struggle the most with capacity building to keep climate change from impacting human rights. For instance, Arctic communities, whose traditional knowledge about the ice is no longer able to inform food security decision-making, can still make significant contributions to climate-energy-water implications for climate mitigation and adaptation. Inclusive decision-making and resilience diffusion empowers these communities. International cooperation can establish protection mechanisms for climate-displaced individuals, both within and across national boundaries. Similarly, global collaboration can achieve sustainable development pathways that encompass climate mitigation and adaptation. The United Nations Framework Convention on Climate Change highlights the precautionary principle and intergenerational equity – two key norms that can contribute to further human rights protections.[69] Bringing together international economic, human rights and environmental law can advance sustainable development.

Lemley observes that new innovations are often "invented simultaneously or nearly simultaneously by two or more teams working independently of each other,"[70]

COMMISSIONER AND THE SECRETARY-GENERAL 5, A/HRC/10/61 15 January 2009, *available at* http://daccess-dds-ny.un.org/doc/UNDOC/GEN/G09/103/44/PDF/G0910344.pdf?OpenElement

[65] http://ap.ohchr.org/documents/E/HRC/resolutions/A_HRC_RES_10_4.pdf.

[66] A/HRC/19/34, Dec. 16, 2011, *available at* http://www2.ohchr.org/english/bodies/hrcouncil/docs/19session/A.HRC.19.34_en.pdf (Human Rights Council Nineteenth session Agenda items 2 and 3 Annual report of the United Nations High Commissioner for Human Rights and reports of the Office of the High Commissioner and the Secretary-General Promotion and protection of all human rights, civil, political, economic, social and cultural rights, including the right to development.)

[67] *Mary Robinson Foundation - Climate Justice* at 1, *available at* http://www.mrfcj.org/about (discussing women's role at the forefront of climate justice initiatives.)

[68] CESCR general comments No. 12, para. 7, and No. 15, para. 11.

[69] HUMAN RIGHTS COUNCIL, ANNUAL REPORT *supra* 64 note 29.

[70] Mark A. Lemley, *The Myth of the Sole Inventor,* 110 MICH. L. REV. 709 (2012) ("patent owners--even the owners of the most famous and important inventions--are overwhelmingly not people who have invented something no one else could have done. They are making incremental improvements alongside others tackling the same problem and often coming up with the same solution at about the same time.") *Id.* at 738; *See also* Brian J. Love, *Interring the Pioneer Invention Doctrine*, 90 N.C. L. Rev. 379 (2012). ("dominant pioneer patent rights generally stifle rather than promote innovation because they significantly discourage investment in the development of next-generation technology") *Id.*

which he concludes is problematic for classic theories of patent law. Lemley suggests that patent races might be worth supporting.[71] He recommends surveying innovators to further flesh out what motivates individuals and groups to invent. He identifies that some sectors progress irrespective of patents, noting that "[o]rdinary economic rents, coupled with non-patent advantages such as first-mover benefits and brand reputation, have long proved sufficient to encourage entry into new markets even in the absence of patent protection. We don't have computer software or social networks because of patents; indeed, if anything, patents interfere with market entry in those fields."[72] Lemley evaluates how patents can inhibit enabling inventions that are the gateway to a wide array of other innovations.

Patent pools and exemptions offer useful approaches for some technologies while they stall innovation in other areas. Just as one technology will not fit all local conditions, one intellectual property approach does not fit all climate cooperation contexts. Innovation governance provides a transactional framework within which to coordinate supply and demand for technology solutions. Currently, small company (and country) market entry is problematic in the face of incumbent predominance in the intellectual property landscape. Moreover, lending is often conditioned upon borrowers having existing patents. Elsewhere I have explored international institutional change agent leadership in integrating energy access into development goals.[73] Here I focus on the role that networks can play in facilitating environmentally sound innovation and diffusion that is mindful of science and equity.

Least developed countries should not be the dumping ground for technology transfer of obsolete energy infrastructure while other states transition to lower GHG options. Least developed countries may not be in a position to transition to the most advanced technologies in the near term but they can, through global network cooperation, pick their low lying energy efficiency and renewable fruit. In other words, rainwater harvesting, drip irrigation, black carbon mitigation through solar and advanced cook stoves are simple, often off patent, technologies that do not present significant intellectual property right (IPR) obstacles but do require enabling conditions to bring to scale across whole continents. Without country targets, least developed countries will likely rely on the international community to facilitate such climate mitigation. Furthermore, human rights strengthen the already strong climate impetus for balancing IPR objections to technology transfer with rationales for appropriate adaptive open licensing, patent pooling, innovation incentives such as prizes, and other subsidies.[74]

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[71] *Id.* at 750 ("It is often competition, not monopoly, that spurs innovators to action.") *Id.* at 754.

[72] *Id.* at 740.

[73] Elizabeth Burleson & Diana Pei Wu, *Non-State Actor Access and Influence in International Legal and Policy Negotiations*, 21 FORDHAM ENVTL. L. REV. 193, 201 (2010); *see also* Humphreys, *supra* note 30 at xvi (noting that "[a]t present, 1.4 billion people live without access to electricity and at least 2.7 billion depend on biomass burning for their cooking and heating. A recent report by a special advisory group to the UN Secretary-General makes clear that universalising access to modern and clean energy technologies is affordable, manageable and urgent.") *Id.* at xvi.

[74] Humphreys, *supra* note 30 at xvii (Policy on technology need not pivot entirely on IP rights – many of the technologies in question do not involve significant patent royalties.) *Id.*

Enhancing community based innovation and sharing know-how can optimize environmentally sound technology diffusion by adapting technologies to local cultural or geographic circumstances.[75] To this end, open-source collaboration provides the efficacy and transparency with which to overcome existing information asymmetries. While markets can increase demand for innovations, they do not tend to direct knowledge goods to those not able to pay for them. As I have explained in a series of articles and presentations since 2009, innovation prizes and other policy incentives can incentivize innovation irrespective of IPRs and can likely increase the pace of environmentally sound technology diffusion.[76]

B. Taking Stock of Innovation Networking Governance

The new Climate Technology Centre and Network is well positioned to enhance the diffusion of pro-poor, ecosystem based, and environmentally sound technologies. The Climate Technology Centre and Network can help coordinate Green Climate Fund financing to share R&D as well as existing mitigation and adaptation technologies.[77]

At Durban in 2012, the UNFCCC parties took further steps to launch the Climate Technology Center and Network[78] and established a Durban Forum to share ideas and best practices for capacity building.[79] The new Adaptation Committee is tasked with coordinating distribution of Green Climate Fund financing to low-income country adaptation measures, many of which will depend upon environmentally sound technology. Now that the Technology Mechanism is being established, low-income parties can develop and submit project proposals. These developments increase the ability of countries to cooperate in order to reach Cancún commitments agreed to in 2010. Further work to be done includes identifying resources to carry out this innovation networking governance and linking innovation hub initiatives into a catalytic network.

Coordinating economic, human rights, and environmental dynamics of innovation requires substantial cooperation and insight going forward. The complexity of each of these respective regimes makes the challenge of collaborating on innovation that much more crucial. Discussing the TRIPS / UNFCCC nexus on technology transfer can help

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[75] KEITH E. MASKUS AND RUTH L. OKEDIJI, INTELLECTUAL PROPERTY RIGHTS AND INTERNATIONAL TECHNOLOGY TRANSFER TO ADDRESS CLIMATE CHANGE: RISKS, OPPORTUNITIES AND POLICY OPTIONS 15 (2010).

[76] *See* Elizabeth Burleson, *Energy Policy, Intellectual Property, and Technology Transfer to Address Climate Change*, *supra* note 32 at 81; *See also* MASKUS AND OKEDIJI, *supra* 75 note at 16 (Reasons that innovators may forgoe patents include: patent filing and maintenance fees, ability to use trade secrets, and long waiting periods to receive patents.)

[77] Joshua Sarnoff, THE PATENT SYSTEM AND CLIMATE CHANGE, 16 Va. J.L. & Tech. 301, 333 (2011); *see also* UNFCCC Convention, at art. 4.1(c) *supra* note 20 (The climate network can help facilitate "global demonstration programs, open innovation mechanisms (including technology prizes and platforms), model research and development agreements, improved operation and maintenance practices and training and organizational procedures, patent pools, and public databases on licensing activities.") *Id.*

[78] Decision -/CP.17, National Adaptation Plans; *see also* FCCC/CP/2011/L.8/Add.1.

[79] Id. ¶¶ 144–56.

close the 6-11 gigaton greenhouse gas gap.[80] It remains important to provide a framework for innovation hubs that ensures environmentally sound technology transfer. Life cycle analysis, capacity building, and cultural sensitivity need to be ongoing, adaptive, and central to discussions.

Optimizing cooperative transboundary green innovation can facilitate inclusive decision-making, just as public participation by civil society can help economies transition to environmentally sound energy use. Public participation by civil society increases procedural legitimacy. Meaningful consent requires governments to facilitate processes by which members of the public analyze the appropriate level of governmental intervention. While scientists can narrow the range of technical uncertainty, ordinary individuals have the capacity to make value judgments. A transparent, international forum facilitates inclusive decision-making. This is important since the means often are the ends. How one makes a decision affects the substantive provision enacted. Good governance involves accountability, transparency, participation, consensus building, responsiveness, effectiveness, efficiency, and equity.[81] Inclusive climate-consensus building can help achieve genuine sustainable development on the global scale and gather innovation insights well suited to pluralistic community dynamics.

C. Recommendations for Inclusive Innovation Hubs

I argue that the top priority for the Technology Mechanism should be to adopt the Agenda 21 definition of environmentally sound technology and clarify requirements for environmental integrity. Similarly, setting forth good governance procedures for the new Technology Mechanism should also be prioritized as instrumental to effective innovation cooperation.

With regard to least developed countries, if Technology Mechanism activities become based upon country requests for assistance then it is crucial to remain mindful that least developed countries are not well positioned to request such assistance. Another area that still needs to be hammered out includes what permanent funding link will facilitate innovation governance, beyond the interim connection to the GEF (Global Environment Facility).

Potentially, the Technology Mechanism can expand upon the prototype of the UNFCCC's own clearinghouse called "TT: Clear,"[82] in the spirit of Linux and in

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[80] UNEP, *Bridging the Emissions Gap to Meet 2-Degree Target Doable*, Nov 23, 2011, at 1, *available at* http://www.unep.org/newscentre/default.aspx?DocumentID=2659&ArticleID=8955 (UNEP "[o]utlines the Pathways to 2020 Able to Deliver the Additional 6 to 11 Gigatonne Cuts Needed to Get World onto Safe track").

[81] United Nations Economic and Social Commission for Asia and the Pacific, *supra* note 11.

[82] Websites designed as "clearing houses" to facilitate "information exchange" (such as the UNFCCC's own "TT: Clear") *see* unfccc.int/home/items/3092.php; s*ee also* STAKEHOLDER FORUM FOR A SUSTAINABLE FUTURE, DIVISION FOR SUSTAINABLE DEVELOPMENT OF THE UNITED NATIONS DEPARTMENT OF ECONOMIC AND SOCIAL, AND EUROPEAN COMMISSION, UNITED NATIONS DEPARTMENT OF ECONOMIC AND SOCIAL AFFAIRS DIVISION FOR SUSTAINABLE DEVELOPMENT SUSTAINABLE DEVELOPMENT IN THE 21ST

cooperation with such initiatives as the open source Eco-Patent Commons and sliding scale GreenXchange.[83] Knowledge portals can share best practices through on-line uploading/downloading of innovations and consequently help spread environmentally sound distributed power, battery innovation, rainwater harvesting, drip irrigation, culturally sound solar cookers and a wide array of other environmentally sound technologies. In addition to online clearinghouse capacity building, on the ground innovation hubs can form a global network of innovation centers to facilitate diffusion of climate friendly innovations.

The Climate Technology Center and Network can expand the international "innovation ecosystem" – helping countries continue ongoing needs assessment and approaches suited to given countries.[84] Governance models upon which the Technology Mechanism can build include the efficient secretariats for: REN21, UNEP, and U.S. National Renewable Energy Laboratory (NREL). [85] The climate network can maximize

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CENTURY (SD21), Review of implementation of Agenda 21 and the Rio Principles (2012) *available at* http://www.un.org/esa/dsd/dsd_sd21st/21_pdf/SD21_Study1_Agenda21.pdf. (discussing coordination of common standards and definitions of web-based technology information clearing house coordination, "linking TT:CLEAR to national and regional technology centres including the UNEP Sustainable Alternatives Network (SANet), the Clean Energy Portal (CEP), Canada, the Climate Technology Cooperation Gateway of the United States of America (US-CTC Gateway), the International Technology Trade Centre (ITTC) of Tsinghua University, China, and the Tunis International Centre for Environmental Technologies (CITET)."); *See also* http://cleanenergysolutions.org/; *See also* http://ClimateTechWiki.org; *see also* WIPO INPUT FOR THE COMPILATION DOCUMENT FOR THE PREPARATORY PROCESS OF THE UN CONFERENCE ON SUSTAINABLE DEVELOPMENT *supra* 40 note at 2.

[83] *See* Eco-Patent Commons, World Business Council for Sustainable Development, *available at* http://www.wbcsd.org/work-program/capacity-building/eco-patent-commons.aspx; *see also* GreenXchange, *available at* http://www.thegreenx.com/

[84] LETHA TAWNEY, FRANCISCO ALMENDRA, PABLO TORRES, AND LUTZ WEISCHER, TWO DEGREES OF INNOVATION—HOW TO SEIZE THE OPPORTUNITIES IN LOW-CARBON POWER, WORLD RESOURCES INSTITUTE 39 (2011), at 1 *available at* http://pdf.wri.org/working_papers/two_degrees_of_innovation.pdf; *see generally* HELEEN DE CONINCK, CONCEPTS ON THE IMPLEMENTATION FRAMEWORK FOR THE CLIMATE TECHNOLOGY CENTER AND NETWORK UNDER THE UNFCCC, COORDINATED LOW EMISSIONS ASSISTANCE NETWORK (2011) *available at* http://prod-http-80-800498448.us-east-1.elb.amazonaws.com/w/images/a/a8/CTCN_Implementation_Framework_CLEAN_paper.pdf; *See also* THE CLIMATE TECHNOLOGY MECHANISM: ISSUES AND CHALLENGES 10 (2011) ICTSD *available at* http://ictsd.org/downloads/2011/04/technologymechanism.pdf ("Overall, the new T echnology Mechanism potentially represents a step to move beyond the 'conventional' approach to technology transfer under the climate regime – based essentially on capacity building and technology needs assessments – to a more 'dynamic' one geared towards fostering public-private partnerships; promoting innovation; catalysing the use of technology road maps or action plans; mobilizing national, regional and international technology centres; and facilitating joint R&D activities. The task facing the Technology Mechanism is arduous.") *Id.*

[85] HELEEN DE CONINCK, CONCEPTS ON THE IMPLEMENTATION FRAMEWORK *supra* note 84 at 15; *see also* MAJOR GROUP FOR CHILDREN AND YOUTH CONTRIBUTION TO THE OUTCOME DOCUMENT OF RIO+20 (2011), *available at* ("The creation of a 'Global Technology Sharing Facility,' which would enhance sharing, enable prior assessments and provide monitoring of technology on the global scale. Alternatives to market-based intellectual property rights have to

learning opportunities to build on one another's insights through opportunities to come together in forums and visit each other's innovation hubs (both virtually and in the field). Such networking can facilitate community data systems, webinars, and outreach tailored to given communities.[86] Local, regional, sectoral and global innovation forums together with clearing houses can form resilient innovation hubs. Organizations and initiatives can share best practices, provide technical assistance, tackle new innovation challenges and work together to address remaining obstacles to environmentally sound innovation diffusion. [87]

Technology transfer has been a central factor in ongoing climate network coordination efforts since the drafting of the United Nations Framework Convention on Climate Change (UNFCCC). Article 4.5 of the Convention requires developed countries to "take all practicable steps to promote, facilitate and finance, as appropriate, the transfer of, or access to environmentally sound technologies and know-how to other Parties, particularly developing country parties to enable them to implement the provisions of the Convention."[88] The Intergovernmental Panel on Climate Change defines technology transfer as "a broad set of processes covering the flows of know-how, experience and equipment for mitigating and adapting to climate change amongst different stakeholders such as governments, private sector entities, financial institutions, non-governmental organizations (NGOs) and research/education institutions."[89] The new Technology Mechanism, established in the December 2010 Cancún Agreements, can coordinate a catalytic transgovernmental network that, among other activities, shares best practices.[90]

A Technology Mechanism has been established under the UNFCCC Conference of the Parties, consisting of (1) a Technology Executive Committee (TEC) and (2) a Climate Technology Centre and Network (CTCN). Implementing the technology transfer framework of Article 4, paragraph 5 of the UNFCCC will be a priority for the TEC. The

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be developed and new digital information infrastructures could foster the rapid circulation of knowledge and technologies worldwide, based on the notions of fair access and mutual benefit sharing. We must also protect and nurture traditional, local and Indigenous knowledge and recognise their value as alternative technologies. Public and private stakeholders must collaborate internationally and strive to incorporate cradle to cradle design into new and existing technological and product lifecycles.") *Id.*

[86] *Id.* at 17.

[87] *See generally* ICTSD, PROPOSALS ON BEHALF OF THE INTERNATIONAL CENTRE FOR TRADE AND SUSTAINABLE DEVELOPMENT (ICTSD) TO THE RIO+ 20 PREPARATORY PROCESS (2011) *available at* http://www.uncsd2012.org/rio20/content/documents/455Submission%20Rio20%20ICTSDFINAL.pdf.

[88] UNFCCC Article 4.5 *supra* note 20; *see also* Article 4.7 establishes a clear link between the extent to which developing countries will implement their commitments under the UNFCCC and the effective implementation by developed countries of their commitments relating to financial resources and the transfer of technology." *Id.*

[89] IPCC, METHODOLOGICAL AND TECHNOLOGICAL ISSUES IN TECHNOLOGY TRANSFER, A SPECIAL REPORT OF WG III (Cambridge Univ. Press 2002).

[90] *Outcome of the work of the Ad Hoc Working Group on Long-term Cooperative Action under the Convention* (United Nations Framework Convention on Climate Change Secretariat, December 12, 2010), chapter IVB, http://unfccc.int/files/meetings/cop_16/application/pdf/cop16_lca.pdf.

CTCN will gather regional, state, sectoral and civil society technology network participants to enhance technology transfer. The CTCN will facilitate existing networks, organizations, and initiatives in order to provide assistance to developing countries on identifying technology needs, implementation, and deployment. [91] The UNFCCC Conference of the Parties has also decided to strengthen capacity building support via networks for sharing communication, education, information, public awareness, training and stakeholder participation. [92]

Best practices in innovation cooperation include knowledge sharing as well as joint research, development and demonstration.[93] Network leadership can involve UNFCCC's Climate Technology Center and Network, Clean Energy Ministerial, International Renewable Energy Agency (IRENA) and other innovative collaborations.[94] Dedicated to renewable energy, the new IRENA[95] may be able to catalyze a more timely pace of action than has occurred within the UNFCCC.[96] Developing country change agents, such as IRENA and UNDP supported projects in the field, can begin to address the enabling environment rationale with which developed countries have based slow implementation of technology transfer.

IPRs can be balanced with innovation sharing in a manner that neither stems the flow of environmentally sound technology transfer nor divests property rights wholesale. It is clear that IPRs remain a political stumbling block for countries such as the United States where large innovative corporations have influenced state negotiating.

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[91] Decision 1/CP.16 includes the outcome of work by the Ad Hoc Working Group on Long-Term Cooperative Action under the Convention (AWG-LCA) and covers the main elements of the Bali Road Map. Decision 1/CMP.6 reflects the outcome of the work undertaken by the Ad Hoc Working Group on Further Commitments for Annex I Parties under the Kyoto Protocol (AWG-KP). at 121. (The TEC will consider and recommend actions to promote environmentally sound technology transfer; provide guidance on policy and program priorities; facilitate collaboration between governments, the private sector, NGOs, and academic and research communities; recommend actions to address barriers to technology transfer; and catalyze development and use of technology road maps or action plans.)

[92] *Id.*

[93] LETHA TAWNEY AND LUTZ WEISCHER, INNOVATION AND TECHNOLOGY TRANSFER: SUPPORTING LOW CARBON DEVELOPMENT WITH CLIMATE FINANCE INTERNATIONAL INNOVATION SYSTEM 1 (2011) WRI *available at* http://pdf.wri.org/working_papers/innovation_and_technology_transfer.pdf.

[94] *Id.*

[95] IRENA - International Renewable Energy Agency, *available at* http://www.irena.org/home/index.aspx?mnu=hom; *see also* TAWNEY AND WEISCHER, INNOVATION AND TECHNOLOGY TRANSFER *supra* note 93 at 5 ("IRENA represents a multilateral approach to tapping expertise and collecting information. Where the Clean Energy Ministerial initiatives are geared towards middle income and emerging economies, IRENA has very broad participation, like the UNFCCC. It is intended to permanently house expertise on renewable energy development and implementation, though with a heavy focus on the latter.") *Id.*

[96] "Technology transfer and innovation happen within a complex system of relationships between governments, companies, financiers, regulators and others. The UNFCCC cannot fulfill all of the functions necessary for an effective international system of innovation. Many other forums are important to incubating innovation and ensuring successes spread widely and quickly," TAWNEY AND WEISCHER, *supra* note 93 at 1.

Furthermore, technology transfer has been held back, despite "oven ready" language, as a bargaining chip with which to negotiate more contentious issues such as measurable, reportable, and verifiable (MRV) mitigation commitments.[97]

The international community can build upon the new technology mechanism under the United Nations Framework Convention on Climate Change (UNFCCC)[98] to share environmentally sound technologies such as solar lamps, solar cookers, drip irrigation, and rainwater harvesting. Such innovations can lower fuel consumption per unit of power generated and expand access to energy.

An international database housing green technologies and best practices[99] can enhance implementation of technology transfer and enabling activities such as technical training, capacity-building, and R&D cooperation.[100] The technology mechanism should facilitate sectoral technology cooperation by sharing best practices and best available technologies, both current and emerging.[101]

Coordinated public private initiatives should diffuse environmentally optimal technologies and practices across power production, transportation, and waste management.[102] Countries should enhance inclusive gatherings and networks with civil society.[103] Global cooperation should ramp up efforts to find replacement technologies to address climate security. Best practice diffusion requires information sharing, awareness raising, and capacity building to realize co-benefits from climate mitigation and other shared goals.

Green building exemplifies a public private practice that can integrate social equity and environmental concerns. Jurisdictions are beginning to implement the private Leadership in Energy and Environmental Design (LEED) rating system that establishes a

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[97] Elizabeth Burleson and Cesare Romano, "Cancun Climate Negotiations," 15 AMERICAN SOCIETY OF INTERNATIONAL LAW INSIGHT 41 (2011) *co-author*.

[98] *See* UNFCCC Article 4.5 *supra* note 20; *cf.* A Universal Declaration of Human Rights, G.A. Res. 217 (III) A, art. 27(1), U.N. Doc. A/RES/217(III), (Dec. 10, 1948), *available at* http://www.un.org/en/
documents/udhr/index.shtml#a27 ("Everyone has the right freely to participate in the cultural life of the community, to enjoy the arts and to share in scientific advancement and its benefits.") *Id*.

[99] *Id.* ¶ 195.

[100] *See Id.* ¶ 196.

[101] *Id.*

[102] VAN SMITH, ENABLING ENVIRONMENTS OR ENABLING DISCORD: INTELLECTUAL PROPERTY RIGHTS, PUBLIC-PRIVATE PARTNERSHIPS, AND THE QUEST FOR GREEN TECHNOLOGY TRANSFER, 42 GEO. J. INT'L L. REV. 817, 848 (2011) (discussing the advantages of Public-Private Partnerships (PPPs).

[103] William Boyd, *Climate Change, Fragmentation, and the Challenges of Global Environmental Law: Elements of a Post-Copenhagen Assemblage*, 32 U. Pa. J. Int'l L. 457 (2010) ("In order for nested, polycentric forms of climate governance to work, they will have to be assembled from above and below, with careful attention to who wins and who loses, careful attention to the tactical opportunities that emerge to influence the assemblage in ways that enhance meaningful participation across and within the different nested levels. The project of global environmental law, if it is ever going to be more than a catch-all for the varied and variable forms of transnational environmental governance taking shape in multiple domains, will need to engage with all of this in much more direct fashion, which means getting out and working in these diverse and complicated places, getting out and understanding how global projects are being worked out in concrete institutional settings all over the world.") *Id.* at 549-550.

point system.[104]

The Green Building Council offers a framework for action based upon (1) enhancing zoning codes and development ordinances for green building and (2) condition public financing on sustainability criteria.[105] With the LEED rating system for green buildings currently covering nearly 10 billion square feet of real estate globally, the Green Building Council proposes that broad support for resilient sustainable infrastructure can reduce poverty, enhance environmental sustainability, and address equity.[106]

A just transition to a green economy requires frameworks that are responsive to present and future societal needs in an accountable, effective, transparent, equitable, and inclusive manner. Devolving environmental regulation to industry moves issues out of the public sphere. People have a right to participate in decisions that affect their social and physical environment.[107] One area in which this public participation versus industry experts discussion is being played out is within the growing field of green building standards, which are in flux as jurisdictions recognize the need to mitigate climate change. Building codes seek to preserve health, safety, and welfare while enabling private development of land. Governance has expanded to encompass water management, construction materials, indoor air quality, and efficiency.[108] The private, voluntary LEED program[109] awards points for a myriad of environmental measures. In addition to subsidies, loans and fast track permitting, communities have used LEED as a basis upon which to incentivize green building.[110]

Linking network clearinghouses of best practices would facilitate increased efficiency and sound energy use.[111] Solutions can vary from region to region. While not suitable to all locations, straw bale construction is earthquake-resilient, is a great insulator

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[104] *See generally* U.S. Green Building Council, LEED Rating Systems, http://www.usgbc.org/DisplayPage.aspx?CMSPageID=222 (discussing the LEED rating systems).

[105] *See generally* BUILDING THE GREEN ECONOMY FROM THE GROUND UP: SUSTAINABLE CITIES AND THE BUILT ENVIRONMENT (2011) Prepared jointly for the 2012 United Nations Conference on Sustainable Development (Rio +20) Compilation Document by the U.S. Green Building Council and the Green Building Council Brazil, *available at* http://www.uncsd2012.org/rio20/content/documents/Building%20the%20Green%20Economy%20from%20the%20Ground%20Up.pdf (suggesting that the international community invest in resilient, green buildings.) *Id.*

[106] *Id.*

[107] Lopez Ostra v Spain 16798/90 [1994] ECHR 46 (9 December 1994) and Guerra v. Italy 14967/89 [1998] ECHR 7 (19 February 1998).

[108] For a discussion of tribal governance in the area of land use *see* Nicholas Fromherz and Joseph Mead, *Equal Standing with States: Tribal Sovereignty and Standing After Massachusetts v. EPA,* 29 STAN. ENVTL. L. J. 131 (2010).

[109] U.S. Green Building Council, LEED Rating Systems, *supra* note 104; *see also* Charles J. Kibert & Kevin Grosskopf, *Envisioning Next-Generation Green Buildings*, 23 J. LAND USE & ENVTL. L. 145, 148 (2007).

[110] *See generally* Edna Sussman, *Reshaping Municipal and County Laws to Foster Green Building*, *Energy Efficiency, and Renewable Energy*, 16 N.Y.U. ENVTL. L.J. 1 (2008).

[111] Stephen Miller, *Commercial Green Leasing in the Era of Climate Change: Practical Solutions For Balancing Risks, Burdens, And Incentives*, 40 ENVTL. L. REP. NEWS & ANALYSIS 10487, at 10495 (2010).

and promotes tribal youth jobs. Communities can build sustainable quality homes that save water, reduce energy bills, and help people become resilient to climate extremes while contributing to climate adaptation and mitigation.

Transparent, legitimate, and accountable governments are the most likely to be able to achieve good governance and cooperate with one another in decision-making forums. This cooperation involves time and trust. Governments and civil society must remain committed to justice, respecting varying cultural approaches to conflict resolution.

Human rights and environmental institutions have the capacity to bring people together to address governance gaps. Reaching carbon neutrality in an affordable, environmentally sound way requires integrating strategies between mitigation, adaptation, development, and disaster risk reduction in a manner that is mutually reinforcing and mindful of disadvantaged communities.

Public participation can sustain trust in governments and strengthen the legitimacy of legal decisions. Inclusive stakeholder participation brings new perspectives to problem solving as well as trust and support for implementation. In this manner environmental justice can be integrated into an effective, equitable environmental protection program.

D. Looking Forward: Catalytic Intra-Network Dynamics

Taylor-Ide's work highlights the importance of beginning simply, being true to process, remembering that the means are the ends, and growing capacity through networks.[112] Nesting network norm generation can lead to international coordination at a level and pace at which cooperation can be sustained. Network activities can involve policy coherence high level panels, EST special procedure and disseminating knowledge sharing studies. Such norm generation may facilitate the geo-political climate with which to consider a joint reciprocal protocol among such international regimes as the WTO and UNFCCC.

UN bodies can diffuse the human rights frame for innovation and diffusion through recommendations in the context of their mandates, be they human rights oriented like UNHCR, environmentally oriented like UNEP, or trade and IP oriented like the WTO and WIPO. Just as UNESCO coordinates UN-Water, WIPO would be well positioned to help provide coordination leadership on Climate-IPR-Trade-Human Rights.

Networks can take on a variety of forms and functions, including:

- **Judicial Networks** are providing best practices, particularly in building judicial capacity to address international law, environmental science, complex patent disputes and a range of other multifaceted challenges. UNEP and INECE have been change agents for increased networking among judges to increase environmental capacity and scientific literacy.[113]

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[112] *See generally* Daniel C. Taylor, Carl E. Taylor, Jesse O. Taylor, Empowerment on an Unstable Planet: From Seeds of Human Energy to a Scale of Global Change (Oxford University Press: 2012).

[113] INECE, CHAPTER TWELVE, TRANSGOVERNMENTAL NETWORKS 384, *available at* http://inece.org/mlw/Chapter12_TransgovernmentalNetworks.pdf; *see also* Edited

- **Production networks** involve local suppliers from around the world that interact to coordinate the supply and demand of goods and services. Knowledge sharing includes technology and know how passed along global supply chains but least developed countries do not have significant access to such knowledge spillovers.[114]

- **Small Developing Island Renewable Energy Knowledge and Technology Transfer Network (DIREKT)**, with EU funding and universities participation from Germany, Fiji, Mauritius, Barbados and Trinidad & Tobago. Activities include technology centers cooperating on improving renewable energy science and technology innovation and diffusion.[115]

- **Joint European-Latin American Universities Renewable Energy Project** involves universities from Germany, Latvia, Bolivia, Brazil, Chile and Guatemala on university level renewable energy capacity building with which to enhance absorptive capacity for environmentally sound innovations.[116]

- **Climate Action Network (CAN)** coordinates environmental non-state actor involvement in ongoing climate negotiations.[117]

- **International Institutional Networks** include UN Energy, UN Water. These umbrella entities have been able to coordinate state, international organization, and non-state cooperation on cross cutting issues.[118]

This is clearly a snapshot approach but it highlights some of the networks engaged in intra-network collaboration. Among the IP community, WIPO can enhance its ability to coordinate nested networking and be a gateway from the intellectual property community to IRENA and its growing renewable energy community. Similarly, technology network policy coordination can build upon such single sector transboundary networks as water compacts that represent effective intra-network norms generation and transboundary natural resource management. Furthermore, the Regional Greenhouse Gas Initiative (RGGI) offers a transgovernmental network model, one built upon reciprocal enabling

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by Zu Waldeck und Pyrmont Wolrad Prinz, Martin J. Adelman, Robert Brauneis, Josef Drexl and Ralph Nack, and Alison Firth, *Patents And Technological Progress In A Globalized World - Liber Amicorum Joseph Straus,* E.I.P.R. 2010, 32(4), 184-189 (2010) (discussing the need to "increase the expertise of local judges in patent cases, and create new centers for patent cases.") Id. at 473.

[114] MASKUS AND OKEDIJI, *supra* 75 at 5.

[115] Small Developing Island Renewable Energy Knowledge and Technology Transfer Network (DIREKT), *available at* http://www.direkt-project.eu/objectives.html.

[116] *see generally,* Joint European-Latin American Universities Renewable Energy Project, *available at http://www.jelare-project.eu/.*

[117] *see generally*, Climate Action Network *available at* http://www.climatenetwork.org/.

[118] *see e.g.* UN Water *available at* http://www.unwater.org/ and UN Energy's Knowledge Network *available at* http://www.un-energy.org/.

legislation in each participating state. The next section addresses the need to transition from regime shifting to international network coordination.

IV. From Regime Shifting to International Network Coordination

The principle of mutual supportiveness remains an under-theorized area of international law and policy. Yet, it is gaining credence in large part due to its inclusion in the Stockholm Convention on Persistent Organic Pollutants (POPs)[119] and the Doha Declaration.[120] Both instruments also call for the diffusion of environmentally sound technologies; this enhances the capacity for greater coordination among trade and environment forums to work out the details of economically, socially, and environmentally sound innovation sharing.[121]

While knowledge goods are better understood than several decades ago, much remains to be mapped with regard to innovation and diffusion landscapes. International institutions, states, and non-state actors have stepped into this uncertainty and experimented in different directions with different degrees of public support.

When international regimes conflict, it is perplexing how to develop a legal argument by balancing legal principles and the reasons and rationale behind given rules. Legal reasoning often occurs in parallel trade and environmental contexts where theory construction occurs based upon distinct building blocks. Seeking collaboration with the Climate Technology Center and Network, WIPO describes its new initiative as follows:

> WIPO Green enables owners of proprietary technologies to make selected technologies and solutions available as packages, including related know-how, services and materials and facilitates the matching of specific user-formulated needs with technology providers. In addition, it provides additional services, including training, consulting, tailor-made dispute resolution and assistance in getting financial support and acts as a hub

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[119] Stockholm Convention, preambular paragraph 9, which states: "Recognizing that this Convention and other international agreements in the field of trade and the environment are mutually supportive."

[120] Doha Declaration, para. 31 states "[w]ith a view to enhancing the mutual supportiveness of trade and environment, we agree to negotiations, without prejudging their outcome, on (1) the relationship between the existing WTO rules and specific trade obligations set out in Multilateral Environmental Agreements;" *see also* Pieter Jan Kuijper University of Amsterdam, ICTSD Dispute Settlement and Legal Aspects of International Trade ICTSD Programme on Dispute Settlement Conflicting Rules and Clashing Courts The Case of Multilateral Environmental Agreements, Free Trade Agreements and the WTO 41 (2010), Issue Paper No. 10, (noting that multilateral environmental agreements "have been joined by around 170 states, considerably more than the numbers of Members of the WTO. Moreover, the past decades have witnessed not only a proliferation of multilateral environmental agreements, but also of annexes and protocols to those, rendering the party-non-party divide and the resulting legal issues even more complicated.") *Id.* at 15.

[121] Disclosure requirements in multilateral environmental agreements can cause friction with trade objectives, Pieter Jan Kuijper University of Amsterdam, ICTSD Dispute Settlement *supra* note 120 at 16.

> connecting various critical partners, with WIPO facilitating policy dialogue and networking.[122]

There may also be common ground with which to cooperate with the World Bank's efforts to create a "decentralized knowledge platform for low emission development that can provide upstream advice and support to developing countries."[123] Inclusive, collaborative governance of transboundary natural resources continues to challenge the international community. Trade law, IP law, labor law, national security law, climate law, and energy law are among the fragmented sectors that impact environmentally sound innovation diffusion. Public-private coordination can enhance renewable energy and efficiency technologies to least developed countries. The technology mechanism can bring together a broad array of stakeholders to optimize innovation and diffusion through a network of collaborative innovation hubs and public sector incentives.

Increasing the renewable energy mix will require policies to stimulate changes in the energy system.[124] The IPCC notes that monetizing given energy source's external costs would enhance renewable energy's relative competitiveness given the negative externalities associated with fossil fuels. Moreover, value depends on more than simply market cost. Peak electricity demand is just one driver from an array of economic, social and environmental considerations that go into energy choices.[125] The IPCC calls for renewable energy specific policies regarding R&D, demonstration and deployment with which to level the playing field among energy sources.[126] Broadly sharing knowledge on renewable energy can help the pace and scope of its diffusion to least developed countries.[127]

In an effort to map an accessible climate technology landscape, the European Patent Office has begun sharing information regarding a new classification scheme for patents in climate change mitigation technologies. The European Patent Office has created a detailed taxonomy based on the technical attributes of clean energy technologies.[128] An increased understanding of environmentally sound technology

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[122] WIPO INPUT FOR THE COMPILATION DOCUMENT FOR THE PREPARATORY PROCESS OF THE UN CONFERENCE ON SUSTAINABLE DEVELOPMENT *supra* 40 note at 9 (describing WIPO cooperation with WHO on medicines); *see generally* Katherine Strandburg, *Evolving Innovation Paradigms And The Global Intellectual Property Regime*, 41 CONN. L. REV. 861 (2009) (Arguing for an expanded role for WIPO.)

[123] World Bank Group, THE ROAD TO RIO+20 AND BEYOND *supra* 43 note at 3.

[124] IPCC Zero Order Draft *supra* note 2 at 9.

[125] *Id.* at 11 (others include "R&D, economies of scale, deployment-oriented learning, and increased market competition")

[126] *Id.* at 23 ("Policies include regulations such as feed-in-tariffs, quotas, priority grid access, building mandates, biofuel blending requirements, and bioenergy sustainability criteria. Other policy categories are fiscal incentives such as tax policies and direct government payments such as rebates and grants; and public finance mechanisms such as loans and guarantees. Policies can be sector specific and can be implemented on the local, state/provincial, national and in some cases regional level and can be complemented by bilateral, regional and international cooperation.") *Id.*

[127] *Id.* at 23.

[128] Konstantinos Karachalios (EPO) Nikolaus Thumm (EPO); Ahmed Abdel Latif (ICTSD), Pedro Roffe (ICTSD); Benjamin Simmons (UNEP); Tahir Amin (Initiative for

demand factors, the impact of public sector support, and successfully commercialized environmentally sound innovations could flesh out the innovation landscape.[129] Much collaborative work remains to be done regarding the impact of IPRs on environmentally sound technology transfer to least developed countries. Empirical research can provide preliminary maps with which to formulate policy questions and optimize public-private innovation and technology transfer decisions that genuinely address economic, social, and environmental sustainability.

Steven Ferrey has evaluated emerging developing country technology transfer case studies, considering principles shared by small successful renewable energy programs.[130] These include: (1) interconnection requirements, (2) renewable portfolio standards, (3) net metering, (4) bid security bonds, (5) and transparent regulatory processes.[131]

The stability, scope and industrialized nature of domestic markets are intertwined factors that, together with IPRs, impact the global diffusion of environmentally sound technologies. The international community should prioritize global diffusion of mature, off-patent environmentally sound technologies. As the Rio Declaration clarified, "[a] large body of useful technological knowledge lies in the public domain. There is a need for the access of developing countries to such technologies as are not covered by patents or lie in the public domain."[132] Patent offices can provide leadership to facilitate in-depth analysis of patents filed in each environmentally sound sector and identify innovation dynamics. Beyond the private sector's interests in not sharing IPRs and licensing information that can advantage competitors, sharing knowledge on innovation dynamics is both complex and expensive if for no other reason than it requires coordination within and among international and regional institutions, state, academic, private sector and NGOs. Collaboration is underway and would benefit from a greater resource base with which to facilitate diffusion of climate friendly innovations to least developed countries.

Within the patent framework, Joshua Sarnoff recommends "protecting experimentation, sequential innovation, and inter-operability of innovations with the developed patented technologies."[133] Alternatives to the patent system include public procurement, establishing constructed commons, or placing certain innovation in the public domain.[134] Beyond the patent framework, Ashford and Hall's work considers a range of instruments, including university innovation diffusion through hybrid R&D

Medicines, Access and Knowledge (I-MAK)), PATENTS AND CLEAN ENERGY: BRIDGING THE GAP BETWEEN EVIDENCE AND POLICY FINAL REPORT 75 (2010) UNEP, EPO and ICTSD) *available at* http://ictsd.org/downloads/2010/09/study-patents-and-clean-energy_159101.pdf.

[129] *Id.*

[130] Steven Ferrey, INTERNATIONAL ALCHEMY WITHIN THE POST-COPENHAGEN WORLD: TRANSFORMING CRITICAL INFRASTRUCTURE ACROSS TWO HUNDRED DIVERGENT ECONOMIES, 34 HASTINGS INT'L & COMP. L. REV. 303, 319 (2011) (discussing international lessons in renewable development technology transfer).

[131] *Id.*

[132] Rio Declaration's *Basis for Action*, paragraph 9 *supra* note 13.

[133] Sarnoff, THE PATENT SYSTEM *supra* note 77 at 308 ((("Substantial theoretical and empirical uncertainties remain regarding whether the patent system is the best method of promoting innovation and dissemination of technologies.") *Id.*

[134] *Id.* at 308 (describing the similarities of climate innovation to medicines and biodiversity human rights implications of granting IPRs)

centers; grants, subsidies, and tax incentives; removing innovation regulatory barriers; and energy pricing.[135]

UN Secretary General Ban-ki-moon states that "[g]overnments should move towards the transparent disclosure of all subsidies, and should identify and remove those subsidies which cause the greatest detriment to natural, environmental and social resources."[136] The IEA estimates that direct fossil fuel consumption subsidies totaled $312 billion world-wide in 2009.[137] It is no small task to overcome such a powerful collective action problem as climate change, or engage constructively with influential vested interests. In particular, transnational, interdisciplinary, inclusive decision-making takes time and resources. Yet, building upon existing collaborative networks can facilitate greater policy coherence among university innovation centers, individual innovators and stakeholders, private firms, civil society, governments, and nested networks within and partnered with the United Nations system.

Encouraging locally useful human capital can help tailor innovations to community needs through local adaptations. University exchanges[138] can help foster this community development, perhaps building upon existing agricultural extension programs but with much deeper community involvement in the design end of programs. These relationships can encourage interactions between change agents, community participants, and governments. University involvement can also bring in scientists to participate in open innovation. Local least developed country entrepreneurs are ill positioned to join international patent pools, irrespective of how useful the outcome innovations may be for

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[135] Nicholas Ashford and Ralph Hall, *The Importance of Regulation-Induced Innovation for Sustainable Development,* SUSTAINABILITY 2011, 3, 270-292; doi:10.3390/su3010270, Jan. 19, 2011, at 1, *available at* http://www.mdpi.com/2071-1050/3/1/270/pdf ("Government initiatives, policies, and instruments must be integrated so as to co-optimize' multiple goals—to foster innovation for sustainability and to use environmental, health, and safety regulation as well as trade policy to stimulate and encourage that innovation.")

[136] UNITED NATIONS SECRETARY-GENERAL'S HIGH-LEVEL PANEL ON GLOBAL SUSTAINABILITY, RESILIENT PEOPLE RESILIENT PLANET: A FUTURE WORTH CHOOSING at 11; *see also* Mohamed El-Ashry, Senior Fellow, UN Foundation & Chairman, REN21, SCALING-UP RENEWABLES FOR ENERGY SECURITY AND SUSTAINABLE DEVELOPMEN, Keynote Address at Asia Clean Energy Forum, ADB, Manila, June, 22, 2011 at 8 ("We need to phase out fossil fuel subsidies and use taxes and regulations to promote market conditions in which renewable energy can compete but without shifting a disproportionate share of additional burden to the poor.") *Id.*

[137] INTERNATIONAL ENERGY AGENCY, ORGANISATION FOR ECONOMIC CO-OPERATION AND DEVELOPMENT, AND WORLD BANK, THE SCOPE OF FOSSIL-FUEL SUBSIDIES IN 2009 AND A ROADMAP FOR PHASING OUT FOSSIL FUEL SUBSIDIES, IAE, OECD, and World Bank Joint Report Prepared for the G-20 Summit, Seoul (Paris, Washington, DC, November 11, 2010) ("the distribution impacts need to be carefully considered While many studies have shown that the bulk of fossil fuel subsidies disproportionally favor the upper middle classes, some are effectively targeted at providing for the basic energy needs of the poor 51 According to research by the Global Subsidies Initiative, fossil fuel subsidies reform will be more successful if it takes these impacts into account and, among other things, "includes complementary policies that offset any undesired secondary impacts (such as welfare support for the poor, programs to help industries restructure, or longer-term strategies to diversify the national energy supply) *Id.*

[138] *c.f.* NATIONAL RESEARCH COUNCIL, MANAGING UNIVERSITY INTELLECTUAL PROPERTY IN THE PUBLIC INTEREST 6 (National Academies Press 2010).

their impoverished communities. Collaborative R&D in these communities can help diffuse environmentally sound technologies where countries lack funding, R&D capacity, licensing agreements, and Foreign Direct Investment (FDI).

Jurisdictions at all scales should coordinate adaptive renewable energy policies with other energy and non-energy policies. For instance, water intensity should not be exchanged for energy intensity. Slow yet steady progress is underway to map climate technology governance. Legal measures such as feed-in tariffs, renewable portfolio standards, and green building standards can enhance funding and steady implementation of innovation diffusion. Technology Needs Assessments, combined with renewable energy legal incentives, are establishing enabling conditions for developing countries to host environmentally sound technologies.

Capacity building measures as Technology Needs Assessments and renewable/efficiency laws cannot single handedly sustain technology transfer, however. The intellectual property literature suggests that while greater empirical research is necessary, legal plurality with regard to IPR recognition has slowed some corporate willingness to license technologies in states.[139]

The traditional theory of granting IPRs relies upon markets to optimize equilibrated supply and demand. Absent market failure, this approach can sustain global trade without public sector tweaking. Yet, where market failures exist, public sector incentives can help establish markets for such products as renewable energy and efficiency technologies where least developed countries are not able to represent their demand in the form of ability to pay nor are suppliers willing to invest due to IPR protection and such non- market factors as the stability of a given country.

While it is a challenge to fund global innovation and diffusion, linking existing innovation capacity allows the climate technology network to build upon existing university, public sector, development bank, private knowledge goods, NGO monitoring, and individual innovators in a Linux-style approach that builds upon best practices within the expanding public domain. It is legally well-positioned to gather the climate innovators and coordinate with states and other stakeholders. With this trampoline, the technology network may be able to catapult renewable and efficiency knowledge goods into a global public domain. There is a strong argument for prioritizing scaling up the Technology Mechanism to be able to play a catalytic role in innovation and diffusion through funding and broad participation. Why not leave it to existing well-resourced private companies with the capacity to expand production without public intervention in market disequilibrium? IPRs are an already established and growing dominant model. That said, IPRs play an important but limited role in incentivizing public knowledge goods.

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[139] Tom Ewing, *Indirect Exploitation Of Intellectual Property Rights By Corporations And Investors,* 4 HASTINGS SCI. & TECH. L.J. 1 (2012) ("studies indicate that IPRs, particularly patents, play a role in the furtherance of technology markets. However, conclusions about the degree to which IPRs further the technology markets and/or are vital to technology transfers differ somewhat among these studies.") *Id.* at 10; *see also* William Hubbard, *Inventing Norms*, 44 CONN. L. REV. 369 (2011)("requiring patent applicants and owners to pay for other government programs operates as a tax on one aspect of innovation and thus likely slows technological progress.") *Id.* at 409.

Leaving the private sector to engage in corporate responsibility and voluntary measures to diffuse EST through such approaches as the Eco Patent Commons may not achieve climate mitigation and adaptation in a timely manner. Similarly, leaving least developed countries to innovate in their own timeframe to the best of their indigenous capacity is also unlikely to occur in a timely manner.[140]

Beyond the market failure of negative externalities of non-renewable emissions, market failure also challenges jurisdictions to optimize knowledge production since Innovator's incentives are generally tied to recognition and remuneration. Policy-makers can customize incentives to given kinds of innovation processes in response to the enhanced collaborative innovation that has altered the traditional thinking about how to recognize innovation.

Christopher Leslie explains that "[p]atent law does not exist in a vacuum. It is but one component of a country's overall innovation policy. Other elements include government contracts for, and subsidization of, both basic and industry-specific research. Antitrust law, too, should be considered a major component of national innovation policy."[141] Existing innovation collaboration communities include the Eco-Patent Commons. The World Business Council for Sustainable Development hosts the Eco-Patent Commons in which company commitments to license environmental patents on a royalty-free basis. It has been growing since 2008 on an open source model. This model allows use of its innovations but only so long as such use remains open to others.[142] Similarly, the GreenXchange has been working with the Creative Commons since 2010 on model licenses.[143]

I argue that international network coordination can help such property rights approaches complement non-property rights approaches to sustainability generally. Dynamic network governance can also work at appropriate scales of climate-energy-water coordination among economic, environmental and human rights sectors of the international community. The next section will consider coordination among two of these dimensions, considering trade and environment cooperation that balances free trade with environmental integrity.

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[140] *Global Warming Twenty Years Later: Tipping Points Near: Briefing Before the H. Select Comm. on Energy Indep. and Global Warming*, 110th Cong. 1 (2008) (statement of Dr. James E. Hansen, Dir., NASA Goddard Inst. for Space Studies), *available at* http://www.columbia.edu/~jeh1/ 2008/TwentyYearsLater_20080623.pdf; *see also A Special Report on Forests: Something Stirs, But to Save the Forests, the World Needs to Find Somewhere Else to Grow Its Food*, THE ECONOMIST, Sept. 23, 2010, http://www.economist.com/node/17062727 (The global population is likely to increase by half over the next forty years); *see also* IPCC, *Technical Paper on Climate Change and Water*, 28th Sess., Apr. 9–10, 2008, at 32, U.N. Doc. IPCC-XXVIII/Doc.13 (Apr. 9, 2008), http://www.ipcc.ch/meetings/session28/doc13.pdf (explaining that wet regions of the world will become wetter and dry regions will become dryer, according to the Intergovernmental Panel on Climate Change.) *Id.*

[141] Christopher R. Leslie, *Antitrust And Patent Law As Component Parts Of Innovation Policy,* 34 J. Corp. L. 1259 (2009) (noting that "Patent law, however, cannot respond adequately to these forms of misconduct because it is not fundamentally designed to police and punish patent holders; rather, it focuses primarily on policing and punishing infringers.") *Id.* at 1285.

[142] Eco-Patent Commons *supra* note 83.

[143] *Id.*

A. Trade and Environment Policy Coherence

A full analysis of trade and environmental law coordination is beyond the scope of this Article but I will offer a few considerations with regard to cooperation to identify gaps and conflicts between the trade and environment international legal regimes.

The UN Trade and Environment Development Account Project argues that:

> [t]he Doha Ministerial Declaration of the Member States of the World Trade Organization emphasises the importance of the trade and environment nexus in paragraphs 31-33 by: a) mandating further negotiations; b) instructing the Committee on Trade and Environment to give attention to issues including the effect of environmental measures on market access; and c) recognising the importance of technical assistance and capacity building in trade and environment to developing countries.[144]

Similarly, the UNFCCC also has existing provisions upon which to enhance policy coherence, stating:

> [c]ooperation with relevant international organizations, such as with scientific bodies, UN agencies and other conventions, is an important dimension of the Convention process. The Convention itself calls on the COP to "seek and utilize … the services and cooperation of, and information provided by, competent international organizations and intergovernmental and non-governmental bodies" (Article 7.2 (l)). The aim is to ensure that the Convention process has the best scientific and other relevant information available. The COP and its subsidiary bodies also seek to ensure that the climate change related activities of other international organizations are coherent with the Convention process and respond to the needs of the Parties, and that potential linkages and synergies with climate change related matters are appropriately taken into account.[145]

Best practice lessons may be gleaned from the work of the Joint Liaison Group of the Convention on Biological Diversity, the United Nations Convention to Combat

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[144] *UN Trade and Environment Development Account Project, Project Overview available at* http://www.un-trade-environment.org/project_overview.html (noting further that "Millennium Development Goal 7 calls upon the global community to ensure environmental sustainability.") *Id.*

[145] UNFCCC, COOPERATION WITH INTERNATIONAL ORGANIZATIONS, (2012) *available at* http://unfccc.int/cooperation_and_support/cooperation_with_international_organizations/items/2533.php ("Relevant linkages relate, for example, to cross-cutting thematic areas and activities under the three Rio Conventions.") *Id.*

Desertification, and the United Nations Framework Convention on Climate Change.[146] The fact that these are not only all environmental instruments, but also siblings of the 1992 Rio Summit, significantly weakens the proposal that policy coherence among the Rio governance bodies can inform trade and the environment coordination. Moreover, enhancing trade and environment intra-network interaction still leaves the long shadow of a myriad of foreign direct investment and bilateral investment treaty (BIT) provisions that involve head spinning complexity and lack of transparency.[147]

Coordinating public good climate mitigation efforts in the face of free-rider inclinations is further complicated by the difficulty in valuing transboundary harms and pricing greenhouse gas emissions.[148]

How then can the international community build upon these BITS and specialized law to overcome the sense that fragmentation weakens rather than provides resilience? Innovation (both governance and technological innovation) thrives in settings with sufficient structure to provide basic thresholds of governance while enough leeway with which to develop new best practices. This is the dynamic network governance challenge. The sea is wide and where is the boat? It is no small task to address international fragmentation and this Article can only make preliminary proposals in the context of EST innovation cooperation. That said, the international community through the help of conscientious and representative intra-network collaboration can increase cross-regime efforts to address gaps and conflicts as well as build upon synergies.

The following sections will consider three policy coherence approaches: (1) a freestanding instrument, (2) WTO jurisprudence regarding infant renewable industry subsidies, and (3) climate technology network coordination.

1. Free Standing Innovation Sharing Agreement

In 2009, I recommended that states ratify an environmentally sound technology transfer treaty (ESTT).[149] The ESTT still represents a straightforward approach from a theoretical standpoint. Yet, despite progress on a mercury treaty, U.S. insistence on very strong IPR in the last several years impacts the ability to ratify or implement a freestanding treaty on technology transfer, in the energy sector or otherwise. For better or

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[146] *See e.g. Joint Liaison Group of the Convention on Biological Diversity, the United Nations Convention to Combat Desertification, and the United Nations Framework Convention on Climate Change, Ninth meeting*, New York, 14 May 2009, *available at* http://unfccc.int/files/cooperation_and_support/cooperation_with_international_organizations/application/pdf/jlg-09-report-en.pdf.

[147] *See* Katia Fach Gómez, LATIN AMERICA AND ICSID: DAVID VERSUS GOLIATH? 17 L. & BUS. REV. AM. 195 (2011) (discussing the proliferation of bilateral investment treaties (BITs)) 196; *see also* Uché U. Ewelukwa, SOUTH-SOUTH TRADE AND INVESTMENT: THE GOOD, THE BAD AND THE UGLY-- AFRICAN PERSPECTIVES, 20 MINN. J. INT'L L. 513 (2011). (discussing China and Africa innovation coordination).

[148] MASKUS AND OKEDIJI, *supra* 75 at 20 ("Together, the current global IP system is a mosaic of blurred and indistinct lines between ownership rights and public interest goals in the implementation of IPRs.") *Id.*

[149] *See generally* Elizabeth Burleson, "Energy Policy, Intellectual Property and Technology Transfer to Address Climate Change," *supra* note 32.

worse, discourse on technology transfer has morphed into innovation sharing coordination. This development is more collaborative but less rights based. This Article reaches the qualified conclusion that a long-range climate/trade solution involves legally binding country commitments to environmentally sound technology transfer that can be complemented by regional and/or sectoral protocols or memorandum of understanding agreements to flesh out ambiguous language.

International laws with technology transfer provisions include: UNFCCC Article 4.5,[150] TRIPS Agreement Article 66.2, Convention on Biological Diversity (CBD) Article 16,[151] and the Stockholm Convention on Persistent Organic Pollutants Article 12(4)[152] Consequently, it would be useful at this juncture to provide draft article language for an EST innovation agreement, without prejudice to the final outcome with regard to the legally binding nature of such an instrument.

While Kuijper suggests that the WTO has recognized multilateral environmental agreements as *lex specialis*[153] carved out of WTO law, he evaluates the remaining gaps in coordination among trade and environmental law and policy.[154] Kuijper highlights the danger to sustainable development and the functioning of multilateral environmental agreements as deference is given to WTO trade forums with which to settle disputes. Both conflicts of norms where substantive conflicts arise between international regimes and conflicts of jurisdictions in which it is unclear who should resolve the issue make trade and the environment coordination crucial to addressing climate change. [155] Beyond evaluating *jus cogens*,[156] UN Charter,[157] and ILC guidance on harmonization and the Vienna Convention on the Law of Treaties,[158] Kuijper suggests that the WTO join

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[150] UNFCCC 4.5 *supra* note 20.

[151] Convention on Biological Diversity, June 5, 1992, 1760 U.N.T.S. 79.

[152] Stockholm Convention on Persistent Organic Pollutants, May 22, 2001, 40 I.L.M. 532.

[153] *Lex specialis* is a Latin phrase for "law governing a specific subject matter."

[154] Pieter Jan Kuijper University of Amsterdam, ICTSD Dispute Settlement at 41 ("The newer type of framework approach to MEAs as applied in the areas of biodiversity and climate change creates more complicated problems. This is because the WTO dispute settlement system has to react to changing approaches to very broad categories of products, the concrete manifestations of which are still unknown (biotechnological products and their trade) or to approaches to addressing a truly global problem that may take many forms, including the creation of new markets, such as emission trading rights.") *Id. c.f.* JOSH EDERINGTON, SYMPOSIUM: INTERNATIONAL TRADE AND THE ENVIRONMENT SHOULD TRADE AGREEMENTS INCLUDE ENVIRONMENTAL POLICY? (2009) Oxford University Press at 98, *available at* http://content.ebscohost.com/pdf23_24/pdf/2010/5309/01Jan10/47988408.pdf?T=P&P=AN&K=47988408&S=R&D=eih&EbscoContent=dGJyMNLr40SeqK44y9fwOLCmr0qep7RSsKi4TLKWxWXS&ContentCustomer=dGJyMPGptkmzrbVNuePfgeyx44Dt6fIA (discussing negotiation and enforcement linkage issues if climate and trade rules were to be integrated.)

[155] Pieter Jan Kuijper University of Amsterdam, ICTSD Dispute Settlement *supra* note 120 at 1.

[156] Vienna Convention on the Law of Treaties, May 23, 1969, 1155 U.N.T.S. 331 [hereinafter VCLT].

[157] UN Charter Article 103 states: "in the event of a conflict between the obligations of the Members of the United Nations under the present Charter and their obligations under any other international agreement, their obligations under the present Charter shall prevail," *available at http://www.un.org/en/documents/charter/.*

[158] Vienna Convention on the Law of Treaties *supra* note 156; *see also*

consultations underway among for instance the European Courts and engage in broader trade and environment coordination with other international regimes.[159]

I propose that coordinating reciprocal protocols might provide the best means by which to accomplish specific agreement, e.g. subsidies for renewable energy promotion without trade law implications, a method utilized in the Regional Greenhouse Gas Initiative Context. Each participating state established legislation within its own state based upon a collective memorandum of understanding. Together they carry out a regional market to reduce GHG emissions.

At the international trade level, member states to the WTO could agree to amending trade rules to better reflect shared vision to incentivize environmentally sound innovation and diffusion. International regimes could harmonize around using the Agenda 21 definition of the term environmentally sound. Further, nested networks could help build consensus upon detailed criteria to fill gaps and avert conflicts between supporting environmentally sound innovation and unduly impacting free trade. Ongoing work on lifecycle analysis could be folded into this process.

Yet, if subsidies generally and agricultural subsidies in particular are an area where the WTO has yet to facilitate broad international agreement, then how can trade law effectively incentivize a transition to environmentally sound energy policy, production, and use? What are the trade costs of strict climate mitigation? Putting a price on carbon has become shorthand for effectively internalizing the costs of greenhouse gas emissions. If subsidizing infant renewable industries can be viewed by the WTO as within the existing realm of GATT Article XX environmental requirements then WTO jurisprudence can help enforce effective environmental measures, catching only the genuinely fraudulent protective trade measures that try to discriminate on the basis of environmental criteria without achieving an actual environmental benefit. Consider the following questions:

(1) Is the WTO the right decision-making body to make such environmental decisions? The WTO is not a general international decision-making body. It was established and remains predominantly focused upon free trade and reducing such trade barriers as subsidies. While the WTO has a side provision on the environment, the competencies of the WTO are in a field that can be at odds with environmental measures. In balancing economic efficiency, equity, and sustainability, the WTO may not have the best frame with which to make difficult decisions to mitigate GHGs when doing so may impact free trade.

(2) Can the WTO help identify what the trade costs of mitigating climate change will be? While Seattle and Genoa demonstrations show that not everyone is in favor of expanding international trade, the aim of the WTO to avert another global great depression is one worth balancing with the need to mitigate greenhouse gasses.

Henning Grosse Ruse-khan, *The International Law Relation Between Trips and Subsequent Trips-Plus Free Trade Agreements: Towards Safeguarding Trips Flexibilities?* 18 J. INTELL. PROP. L. 325 (2011) (discussing harmonious interpretation under the Vienna Convention on the Law of Treaties (VCLT); *see also* Campbell McLachlan, *The Principle of Systemic Integration and Article 31(1)(c) of the Vienna Convention*, 54 INT'L & COMP. L. Q. 279 (2005).

[159] Pieter Jan Kuijper University of Amsterdam, ICTSD Dispute Settlement *supra* note 120 at 42.

The fact that environmental subsidies to support infant renewable sectors may be misused as a loophole to discriminate against foreign trade requires conscientious scrutiny, not prohibition of environmental subsidies. Such subsidies can be one of the most powerful public sector tools with which to mitigate greenhouse gasses. The WTO offers an existing judicial context in which to make case-by-case determinations on the nature of subsidization, environmental benefit, and discriminatory effect on trade. It is unclear to what degree the WTO is standing in the way of addressing climate change and whether the regime's overlap is a *de minimums* or a substantial obstacle to effectively addressing climate change.

Policy coordination involves recognizing when a free trade consideration should be prioritized and when an environmental or human rights provision should be prioritized. Economic growth generally and trade in particular depend upon a stable climate. A stable climate depends upon balancing development and sustainability. The international community may not need to prioritize wholesale the climate over trade or trade over climate stability. Rather, multilateral cooperation should expand the existing international legal framework to address energy. The issue can be addressed through a free standing instrument, preferably binding, but at least through a memorandum of understanding on environmentally sound energy technology transfer. It could set forth a process for selecting decision-makers that represent both trade and environmental experts. Furthermore, it could set out criteria with which to weigh the trade impact and environmental/social impact of an issue such as China's subsidization of solar panel production.

In the meantime, multilateral collaboration among North-South innovation hubs can perhaps avoid trade implications of public support to environmentally sound innovation and diffusion. If done effectively and at scale, the UNFCCC Technology Mechanism can likely incentivize climate mitigation in a manner that does not impact trade law. Such energy innovation hubs are not mutually exclusive with extending WTO treaty language to directly address environmentally sound energy trade.

Based upon harmonization theory under the Vienna Convention,[160] one plausible approach would involve climate law extending to take on the climate mitigation/adaptation issues that appear to implicate trade law. The UNFCCC predates the WTO but not the GATT. It is not clear which international regime should receive deference if a conflict of laws arises. Therefore, proactive policy coherence initiatives are warranted. Just as U.S. transgovernmental networks hammered out an off-shore energy Memorandum of Understanding (albeit in a much narrower substantive realm), the WTO and UNFCCC can agree to grant each other deference in given circumstances or agree to broad deference in the trade or climate direction based upon the greater public good of one over the other. The WTO dispute system offers a robust yet trade-focused forum with which to consider case-by-case disputes. Technology network coordination could involve broadening the judicial frame when cases have climate implications rather than relying upon trade exceptions and flexibilities.

Alternatively, a balanced freestanding instrument could involve reciprocal responsibilities on the part of members of each international legal regime to implement a

[160] *See generally* Vienna Convention on the Law of Treaties, *supra* note 156.

joint judicial review mechanism that is not hosted by one or the other regime.[161] A high level panel could compose an ad hoc trade-environment-human rights judicial review mechanism (analogous to the post conflict war tribunals or Iran claims tribunal) tasked with bilateral specific dispute resolution or multilateral advisory capacity. In other words, thematic treaty body and international organization networks can play a catalytic role in coordinating environmentally sound technology innovation and diffusion.

2. WTO Consideration of Infant Renewable Subsidies

As this article goes to press, the U.N. Conference on Trade and Development (UNCTAD) is stepping into the trade and environment void by establishing an international forum to address disputes. By meeting twice a year, the forum can contribute to coordinating initiatives and seek shared understandings. Transnational cooperation to address climate change by incentivizing infant renewables does not require overly restrictive local input requirements that give local producers a trade advantage. Economic tools used to internalize environmental externalities need not favor local job markets to be effective climate responses. More often, greenhouse gas emissions fees and markets raise costs for domestic and regional actors. This is the case with cap and trade as well as carbon taxes. UNCTAD trade and environment coordination assistance may contribute to finding conflict avoidance measures but be less qualified to assess the economic and environmental effectiveness of carbon taxes and cap and trade programs, both given the UNCTAD mandate and the short timeframe in which such economic tools have been utilized to address climate change. WTO has responded favorably to the UNCTAD offer to coordinate and has agreed to participate informally at an expert level to explore reconciling environmental governance with trade rules. A key element in such coordination is equal stature among economic and environmental governance realms. If trade actors dominate coordination then interaction may negatively impact environmental measures.

Marie Wilke's work on WTO subsidy law seeks to clarify what constitutes a subsidy and which subsidies are prohibited in the context of feed-in tariffs, concluding that the degree to which feed-in tariffs conflict with WTO rules depends upon the given design/implementation of each program.[162] The roughly seventy-five federal or sub-

[161] This is perhaps more easily done at the EU scale, *see* Matthew Rimmer, *A Proposal for a Clean Technology Directive: European Patent Law and Climate Change*, 3 RENEWABLE ENERGY L. & POL'Y REV. 195 (2011) ("This article charts the conflicted, dissonant policies of the European Union towards intellectual property and climate change.") *Id.*

[162] MARIE WILKE, FEED-IN TARIFFS FOR RENEWABLE ENERGY AND WTO SUBSIDY RULES AN INITIAL LEGAL REVIEW viii (2011) International Centre for Trade and Sustainable Development ICTSD Global Platform on Climate Change, Trade and Sustainable Energy; *see also* Richard H. Steinberg, *The Hidden World of WTO Governance: a Reply to Andrew Lang and Joanne Scott*, E.J.I.L. 2009, 20(4), 1063-1071 (2012) Oxford University Press (discussing international administrative law in the context of the WTO); *c.f.* see generally, Daniel Bodansky, *Multilateral Climate Efforts Beyond the UNFCCC International (2011), Center for Climate and Energy Solutions,* (noting that the "UNFCCC regime could explicitly direct that a particular aspect of the climate change issue be pursued in a different forum. In this case, the relationship between the UNFCCC regime and outside work would be one of delegation.") *Id*. at 2.

federal feed-in tariffs generally involve purchasing and transmission guarantees for eligible renewable energy producers, often including homeowners and businesses. This approach to incentivizing renewable energy may be impacted by the dispute currently before the WTO Dispute Settlement Body (DSB) considering Ontario's domestic content requirement within its feed-in tariff.[163] With regard to renewable subsidies more generally, the United States has charged China with illegal wind and solar subsidies while China has charged the United States with improper wind, solar, and hydroelectric incentives to energy producers in five states.[164] Operationalizing trade law as a means of addressing climate mitigation can occur by coordinating climate mitigation measures with free trade measures in a manner that facilitates global trade and renewable energy sharing.

A freestanding agreement may be the most straightforward but politically constrained approach. The WTO has a trade focus but is increasingly making renewable subsidy decisions. Ideally, these cases may be able to establish a clear standard for environmentally sound energy diffusion given GATT Article XX jurisprudence on environmental protections.[165] Environment-trade regime coordination should involve network coordination to fill existing gaps on what environmental measures may run afoul of international economic law. Review of environmental measures in international economic judicial forums can result in standards for trade in climate friendly innovations. The open question is whether these will be climate friendly standards or overly restrictive standards. Including climate experts as decision-makers in cases could increase the changes that the trade-environment issues would result in balanced decisions. A freestanding instrument among international legal regimes could help specify the provisions of climate expert representation in trade-environmental jurisprudence so that member states of each respective regime would be going forward based upon agreement with the arrangement. In the interim, the best opportunity to ramp up environmentally sound innovation and diffusion is likely to involve linking and coordinating climate technology network innovation hubs.

3. Optimizing Environmentally Sound Innovation Hubs

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[163] Japan v Canada WTO Dispute, *available at* http://www.wto.org/english/tratop_e/dispu_e/disp_settlement_cbt_e/a1s1p1_e.htm

[164] Daniel Pruzin, U.N. Agency Sets Up Forum to Address Conflicts Between Trade, Environment Rules, BNA 188 DEN A-6 *available at* http://news.bna.com/deln/DELNWB/split_display.adp?fedfid=28117328&vname=dennotallissues&jd=a0d4v1x2q7&split=0 ("A number of high-profile trade and environment disputes have recently been brought before WTO dispute panels, including complaints by the United States, European Union, Japan, and Mexico against China's export restrictions on raw materials and rare earths, and a joint EU-Japanese complaint against alleged discriminatory sourcing requirements and illegal subsidies in Ontario's green energy program. In addition, Argentina initiated WTO dispute proceedings Aug. 17 targeting Spanish rules requiring that quotas for biofuels used in transportation be met exclusively with EU fuel."

[165] *See e.g.* Report of the Panel, *United States--Restrictions on Imports of Tuna*, ¶¶ 5.14-.15, DS21/R (Sept. 3, 1991), GATT B.I.S.D. (39th Supp.) at 155 (1993) (*unadopted), reprinted in* 30 I.L.M. 1594 (1991) [hereinafter *Tuna/Dolphin I*]; Report of the Panel, *United States--Restrictions on Imports of Tuna*, ¶ 5.9, DS29/R (June 16, 1994) (*unadopted), reprinted in* 33 I.L.M. 839 (1994) [hereinafter *Tuna/Dolphin II*].

While innovation involves an entire process, from creative spark to diffusion, my use of innovation and diffusion is an explicit effort to highlight the global diffusion challenge. It is also a reflection on the evolution of the discourse away from technology transfer – still important for its hard law character but no longer reflective of the transition to collaborative innovation initiatives.

Optimizing knowledge networking infrastructure can often involve sharing public-sector information and providing guidelines for public-private partnerships.[166] Coordination with UNESCO's Community Learning Centre (CLC) Project could be catalytic for both community education centers and innovation.[167] This partnership could also fold into UNESCO efforts underway on the United Nations Decade of Education for Sustainable Development.[168] Coordination could also build upon UNESCO's leadership initiating and sustaining the Water and Climate Dialogue through UN-Water.[169] This section considers climate innovation center and network design.

If the energy debate has splintered into sawdust, then it may be possible to creatively make use of the sawdust to coax a phoenix to rise. Law can foster energy innovation through network coordination. The new climate technology network augments current international economic law by offering innovation hubs with which to expand the legal regime addressing climate change. This network can be a catalyst for enhancing inspiration, knowledge sharing, and funding mechanisms with which to craft a path forward.

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[166] OECD SECRETARIAT: INPUTS TO THE RIO+20 COMPILATION DOCUMENT *supra* note at 4; *see also* OECD, FOSTERING INNOVATION FOR GREEN GROWTH (2011), *available at* www.oecd.org/document/3/0,3746,en_2649_37465_48593219_1_1_1_37465,00.html OECD (2011); *see also* OECD, INVENTION AND TRANSFER OF ENVIRONMENTAL TECHNOLOGIES (2010) *available at* www.oecd.org/document/28/0,3746,en_2649_37465_48792476_1_1_1_37465,00.htmlOECD.

[167] R. Manowalailao, D. M. Shibly, D. M. Shibly, UNESCO/R. Manowalailao, COMMUNITY LEARNING CENTRES: ASIA-PACIFIC REGIONAL CONFERENCE REPORT (2012) UNESCO/Isamabad *available at* http://unesdoc.unesco.org/images/0021/002159/215911e.pdf (UNESCO's Community Learning Centre (CLC) Project was launched in 1998 in the framework of the UNESCO Asia-Pacific Programme of Education for All (APPEAL). The purpose of CLCs is to promote human development by providing opportunities for lifelong learning to all people in local communities. CLCs support empowerment, social transformation and improvement of the quality of life. The main functions of CLCs are to provide: (a) education and training, (b) community information and resource services, (c) community development activities, and (d) co-ordination and networking.") *Id.*

[168] UNITED NATIONS DECADE OF EDUCATION FOR SUSTAINABLE DEVELOPMENT (2005-2014) EXPLORING SUSTAINABLE DEVELOPMENT: A MULTIPLE-PERSPECTIVE APPROACH EDUCATION FOR SUSTAINABLE DEVELOPMENT IN ACTION LEARNING & TRAINING TOOLS (2012) UNESCO *available at* http://unesdoc.unesco.org/images/0021/002154/215431e.pdf.

[169] *See* UNESCO, WATER AND CLIMATE DIALOGUE ADAPTING TO CLIMATE CHANGE: WHY WE NEED BROADER AND 'OUT-OF-THE-BOX' APPROACHES (2008) United Nations World Water Assessment Programme *available at* http://unesdoc.unesco.org/images/0021/002115/211591e.pdf (explaining that "[w]ater is the primary medium through which climate change influences the Earth's ecosystems and therefore people's livelihoods and well-being.") *Id.*

What will it take for energy innovation to become widespread? The intellectual property, economic, and psychology literatures have settled on some best practices with regard to enabling conditions. Creativity and peak performance have long been the purview of the MIT Media Lab but there is an urgent need to break out of the best practices of such research centers and initiate a network of innovation hubs globally. One challenge is to integrate one of the most significant findings from psychology of creativity research, namely that intrinsically motivated work is more likely to produce more creative output than extrinsically motivated work.[170] Inventor's Workshops provide transdisciplinary open access to knowledge that allows individuals to become experts across multiple domains. This innovation builds upon TechBursts,[171] adding a hands-on component comparable to instructables.com.[172][173] Inventor's Workshops can be gathering places, networks of centers, and diverse nurturing communities that span universities and extend to peer institutions in order to realize multifaceted collaboration.

At the 2012 Durban Conference of the Parties to the UNFCCC, innovators from across sub-Saharan Africa gathered to share their expertise with one another and join innovation networks.[174] Recognizing that law can facilitate environmentally sound innovation, this analysis considers strategies for network coordination through rich and creative transnational engagement.[175]

Copyleft public licenses use intellectual property to facilitate open information sharing and can become a model for climate innovation collaboration.[176] Some least developed countries may already be bypassed by patent filers who sometimes do not even file with the WIPO Patent Cooperation Treaty (PCT) facility.[177] As a result, unfiled patents are in the public domain unless a product that includes the innovation makes its

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[170] Gregory N. Mandel, *To Promote the Creative Process: Intellectual Property Law and the Psychology of Creativity*, 86 NOTRE DAME L. REV. 1999, 2007-2008 (2011).

[171] TechBursts is an approach designed at Georgia Tech in which students create ten minute videos that are encapsulating engaging concepts. *See* Elizabeth Burleson and Winslow Burleson, *supra* note 32.

[172] *See generally* instructables.com

[174] Personal observation.

[175] FREDERICK M. ABBOTT, INNOVATION AND TECHNOLOGY TRANSFER TO ADDRESS CLIMATE CHANGE: LESSONS FROM THE GLOBAL DEBATE ON INTELLECTUAL PROPERTY AND PUBLIC HEALTH ix, 1 (2009), http://www.frederickabbott.com/uploads/innovation-and-technology-transfer-to-address-climate-change.pdf ("There are a number of lessons that can be drawn from the public health-related negotiations, at the WTO and other forums, that may be useful to developing country negotiators addressing IPRs and climate change. Some of these lessons are relatively straightforward: economic and political power substantially influences the outcome of negotiations; the involvement of NGOs and other stakeholders is essential; it is important to shape public opinion through effective communication.") *Id.*

[176] MICHAEL A. GOLLIN, DRIVING INNOVATION: INTELLECTUAL PROPERTY STRATEGIES FOR A DYNAMIC WORLD 34 (Cambridge University Press 2008) ("Yesterday's innovation becomes part of today's accessible knowledge.") *Id.* at 42, 254. "[T]he U.S. Patent and Trademark Office began a pilot program for 'open peer review . . . .'" *Id.* at 113; *see also* Bayh-Dole Act, 35 U.S.C. §§ 200–212 (2006) (applying to inventions made with federal funding); *see also* Jay P. Kesan, *Transferring Innovation*, 77 FORDHAM L. REV. 2169, 2207 (2009).

[177] *See generally* WIPO Patent Cooperation Treaty (PCT) *available at http://www.wipo.int/pct/en/*

way back to a state in which there is a patent for that invention.[178] Furthermore, many climate friendly technologies are off patent. Consequently, IPR protection may not be the leading obstacle to diffusion of climate friendly technologies to least developed countries.

Where IPR remains a core issue for global diffusion of climate friendly technologies, innovations strategies that are collaborative and facilitate partnerships may be more effective than those that result in sharing of patent databases and patent pooling. Just as patent claims may set forth the legal scope of an invention, but not clarify how to reproduce it, patent pools may be too exclusive to effectively diffuse climate friendly technology to least developed countries.[179]

The open access discussion is expanding with regard to environmentally sound innovation diffusion and collaboration. Patent pools, such as the Eco Patent Commons, provide an emerging best practice. On the one hand, they still represent a small number of patents and lack sufficient know-how or support. On the other hand, they place important climate friendly technologies in the public domain. Unfortunately, some of the discussion seems focused on "partial solutions, non-solutions, generalities or rhetoric," [180] according to Cannady. She explains that "[c]ompulsory licensing is to IP law what eminent domain is to real property law: it is generally acknowledged as an essential legal doctrine, but no one wants to be the subject of its exercise."[181] Beyond the overly confrontational nature of compulsory licensing, it fails to foster the relationships that facilitate innovation evolution – where a given invention is improved upon through consensual business relationships such as development collaboration or strategic joint ventures.[182]

Least developed countries can enhance innovation through strengthening science and technology research at the domestic level while collaborating with international counter-parts in partnerships that build upon inventions, evolving climate friendly innovation architecture. This coordination can be achieved irrespective of capitalist, socialist or mixed governance structures. For instance, China has ramped up basic and applied research capacity. China now not only leads in core solar technology but is also gaining ownership rights to storage and material innovations.[183]

Innovation hubs can look at the real cost of coal, oil, gas, and nuclear energy. They can compare advantages of efficiency, storage, distributed power, and the range of renewables/alternative energy options. They can facilitate taking innovations out of the laboratory and diffusing breakthrough technologies broadly. This should be done through commercialization where feasible, and through public sector support.

Enhancing access to environmentally sound innovations can build upon models provided by institutions, such as WIPO.[184] For innovation strategies to resonate in a given

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[178] *See generally* CYNTHIA CANNADY, ACCESS TO CLIMATE CHANGE TECHNOLOGY BY DEVELOPING COUNTRIES A PRACTICAL STRATEGY, ICTSD Intellectual Property and Sustainable Development Series Issue Paper No. 25.

[179] *Id.* at 8.

[180] *Id.* at 4.

[181] *Id.*

[182] *Id.*

[183] China's renewable whitepapers can be found at www.sipo.gov.cn/sipo_English/laws/whitepapers/.

[184] WIPO's IP Audit Tool is *available at* http://www.wipo.int/ip-development/en/strategies/audit.html.

country, inclusive decision-making should optimize renewable sector focus, support for innovation education at all levels, innovation hubs or incubators that gather science, technical, legal, and business skill building. Currently, filing fees for climate friendly innovation often serves as an obstacle to diffusion. Innovation hubs can help expand capacity to draft intellectual property instruments.

Innovation hubs can help coordinate public private matching grant programs in given sectors and oversee the sometimes extensive process of meeting donor requirements. Linking the network of climate technology centers to the Green Climate Fund can streamline this process so that human capital can be spent on renewable and efficiency innovation rather than largely being lost to seeking financing. To this end, tax codes that provide for climate rebates, credits and the like can help facilitate private venture capital investment in climate technology for thinly capitalized start-ups in infant renewable and efficiency sectors.[185] Tax incentives can also facilitate cooperative licensing.[186]

Distorted demand-side signals will probably continue until public sector policy instruments manage to "meaningfully" price GHG emissions – resulting in suboptimal supply of environmentally sound innovations. At the same time, demand for environmentally sound innovation that is suitable to given least developed country communities will also likely remain weak in the absence of network coordination. An IPR and policy incentive smoothie may be needed to achieve broad adoption, adaptation, and accessibility[187]

It is not within the scope of this Article to consider the entire global debate on the property rights impact upon availability of knowledge goods, but I seek to provide preliminary support for the proposition that diversity of policy instruments can optimize climate friendly technology access to least developed countries. Between the two camps advocating for primary reliance on the existing IPR regime on the one hand and government interventions such as compulsory licenses on the other,[188] there is an emerging discourse on what a broader array of policy instruments might include with regard to facilitating EST knowledge good diffusion to developing countries.[189]

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[185] Rochelle Cooper Dreyfuss and Lawrence Pope, DETHRONING LEAR? INCENTIVES TO INNOVATE AFTER MEDIMMUNE, 24 BERKELEY TECH. L.J. 971 (2009) (noting that "[a]s to cash-flow, licensees that lacked the funds to pay the upfront costs might instead provide for payment by negotiable instrument: that is, the licensee would issue a series of negotiable instruments at the time the license was entered into with maturity dates apportioned over the life of the license. If the patent holder needed funds immediately, it could negotiate these instruments without recourse (albeit, most likely at a discount).) *Id.* at 971, 993.

[186] CYNTHIA CANNADY, ACCESS TO CLIMATE CHANGE TECHNOLOGY *supra* note 178 at 22.

[187] MASKUS AND OKEDIJI, *supra* 75 at 1 ("From an economic perspective, IPRs are primarily policy interventions aimed at achieving private solutions to information-based market failures.") *Id.* at 13.

[188] *Id.* at 5 (2010) ("Compulsory licenses, for example, can be useful in some circumstances, particularly where a nation has sufficient economic leverage to induce voluntary licensing by merely threatening to grant a CL. However, they are generally of limited use where domestic production capacity is limited.") *Id.*

[189] *Id.*

If leading economies committed to sustaining a high price of emitting greenhouse gasses through tax, cap-and-trade, or hybrid methodologies, then the cost of EST diffusion may be reduced.[190] An across the board, high carbon price, for instance, could incentivize R&D competition in a myriad of renewable/efficiency and adaptation technologies.

Major and emerging economies may benefit most from public-private investment guarantees, as well as tax exemptions and rebates, while least developed countries may benefit most from the implementation of direct EST diffusion laws.[191] Ideally, the technology mechanism can facilitate partnerships that collectively form a network for ESTs innovation and access that is flexible in its approach given the complexities of local conditions, distinctions among EST sectors, and given technologies. It is no small task to identify what constitutes EST, let alone tailor EST to community needs. [192]

The kind of technology transfer/capacity building varies not only based on local geography and culture but also on stage of development. In other words, once economies of scale have been achieved many renewable technologies will be substantially less expensive yet still may be beyond the ability to pay for least developed countries. BRIC countries (Brazil, Russia, India, and China) have emerging renewable and/or efficiency sectors today and are not strong candidates for receiving free energy products. Yet, innovation cooperation among the US, Japan, EU and BRICs countries can further dynamic breakout innovations.

While states are fiscally constrained in responding to the climate challenge, they have the legal capacity to optimize environmentally and socially sound economic growth through empowering civil society innovation. What does this look like? BRIC countries in particular are in a position to provide innovation leadership. How can the law help governments, markets and civil society stretch their perspectives beyond short-term economic indicators? As EST market failures become better understood, a dynamic discourse is emerging regarding ways for developing countries to venture beyond the "comforting shadow" of the OECD IP law expansion path.[193] Bringing down the initial costs of socially and environmentally sound options can be done through legal and policy measures that are mindful of science, equity and environmental thresholds. Feed-in tariffs, renewable portfolio standards, and innovation hubs that focus on dynamic environmentally sound technology transfer are three ways to facilitate climate-energy far sightness.

Successful involvement in the contemporary knowledge economy can be based upon public sector frameworks that facilitate intangible, nonrivalrous outputs becoming

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[190] *Id.* at 11.

[191] *Id.* at 25.

[192] *Id.*

[193] Jerome H. Reichman, *Intellectual Property In The Twenty-First Century: Will The Developing Countries Lead Or Follow*? 46 HOUS. L. REV. 1115, 1127 (2009); *see also* Laurence Helfer, Karen Alter and M. Florencia Guerzovich, *Islands of Effective International Adjudication: Constructing an Intellectual Property Rule of Law in the Andean Community*, 103 AMER. J. INT'L L. 1, 16-36 (2009) (considering the IP pressures on Latin American states and the resulting collective response of the Andean Group).

tradable knowledge goods.[194] Reichman observes that this can be done through a range of measures beyond intellectual property laws and policies.[195] Maskus agrees that IP law is a starting, not ending point, for innovation law and policy.[196]

V. Recommendations for Closing the Innovation and Diffusion Gap

The 2012 United Nations Year on Sustainable Energy catalyzed ongoing energy-climate cooperation. In the ongoing effort to reach climate consensus, one negotiating strategy is to concentrate on what unites rather than divides. Another is to try to bring in an unconsidered factor that can provide a win-win scenario. Focusing on environmentally sound innovation may be such a pie-growing approach. Inclusive decision-making that takes the need for buy-in seriously can build common ground solid enough to support climate infrastructure. Stakeholders with large and many small stakes can use these stakes to design this infrastructure, rather than hold each other at bay in a standoff. Transcending energy insecurity (and the control that it concentrates) can be done through design and diffusion of environmentally sound innovations. They will have an impact on existing interests, as innovations often do. Rather than clear winners, it seems as though climate hold-outs are seeking to ensure that they do not lose their investments, whether rationally depended upon or not.[197]

Best practice diffusion requires information sharing, awareness raising, and capacity building to realize co-benefits from climate mitigation and human security. The new UNFCCC technology mechanism provides an opportunity to diffuse environmentally sound climate friendly technologies. The technology mechanism can bring together stakeholders and enhance good governance by sharing information and making sensible decisions regarding sustainable development. Decisions informed by an understanding of climate justice can bring together dialogue from development, human rights, environment, trade, and business communities. Energy-food-climate security can be discussed as the interwoven challenge that it is rather than disparate discussions.

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[194] Reichman, *Intellectual Property In The Twenty-First Century, supra* note 193 at 1118; *see also* Meir Pugatch, *The Process of Intellectual Property Policy-Making in the 21st Century--Shifting from a General Welfare Model to a Multi-Dimensional One*, 31 EUR. INTELL. PROP. REV. 307 (2009). *See generally* Keith E. Maskus, Intellectual Property Rights in the Global Economy 2-3 (2000); Amy Kapczynski, The Access to Knowledge Mobilization and the New Politics of Intellectual Property, 117 Yale L.J. 804 (2008).

[195] Jerome H. Reichman, *Intellectual Property In The Twenty-First Century supra* note 193 at 1118-1122 (in many OECD countries is demonstrating that badly configured, unbalanced, over-protectionist IP regimes gradually stifle innovation by making inputs to future innovation too costly and too cumbersome to sustain over time. Such regimes also enable large corporations that are sometimes slothful innovators to accumulate pools of cross-licensed patents that create barriers to entry for the truly innovative small- and medium-sized firms. Properly designed IPRs do, however, protect innovative small- and medium-sized firms from the predatory practices of their larger competitors."). *Id.* at 1122.

[196] Keith Maskus, Intellectual Property Rights in the Global Economy, *supra* note 194 at 2-3.

[197] *See* Penn Central Transportation Co. v. New York City 438 U.S. 104, 98 S. Ct. 2646, 57 L. Ed. 2d 631, 1978 U.S.

Green technology cooperation can help the international community address climate destabilization in a sustainable manner.

More people are venturing beyond their own complex fields into the merging aspects of trade-environment-human rights conversation. The open question is how to coordinate without simply creating institutions that surpass economies of scale with regard to effective implementation. At the same time, substantive coordination among water-climate-energy sectors challenges intra-network dialogue generally and the capacity of individuals to add value. A great deal of consensus building has produced the Climate Technology Mechanism. The next challenge is to incubate and foster this new center and network – to become a part of the NGO, University, patent office, and individual North-South innovation collaboration. The hosting process itself is becoming a collaborative one. With a background in water law, I offer transboundary water compacts as a model with which to procedurally coordinate in a way that is still mindful of sovereignty. A word of caution that resourcing the technology network will be crucial for it to be a catalyst, rather than be constrained on the scale of NAFTA's CEC, which to this day has potential far beyond its fiscal capacity. Elements of good governance from RGGI and the Arctic Council may also be useful in making use of best practices in designing a vibrant environmentally sound innovation network. Much work remains to be done to optimize collaborative, open innovation comparable to user customization of Linux.

Some key elements that the UNFCCC technology network should consider include:

- Given the public good nature of EST and related know how, public-private intra-network cooperation should be prioritized to incentivize EST innovation and diffusion. Government engagement in sustaining availability to public goods is well established in the areas of public education, environmental regulation, infrastructure, and science research. Furthermore, the public sector is best positioned to address market failures by balancing efficiency and equity through such measures as minimizing negative spill overs and asymmetrical information.

- Developed country, first mover competition in the renewables sector may complicate innovation cooperation among the United States, Japan, European Union, and BRIC countries but should not impact climate cooperation for least developed countries. The international community should take an "all hands on deck" approach to ramping up climate mitigation and adaptation technology transfer for frontline least developed communities.

- Green technology packages to address climate change can involve open innovation, licensing and sharing know-how.[198] International and least developed country public sector funding could help support green technology package royalties. Where possible, Linux-like open source cooperation for green

[198] *See generally* Naoto Kuji profile, IP*SEVA stands for Intellectual Property for Sustainable Energy Ventures, *available at* http://ipseva.com/principals/naoto-kuji/

technology diffusion can facilitate North-South dynamics moving beyond the model of one-way dependent technology transfer.

- Climate coordination requires greater intra-network cooperation to understand trade, equity, and environmental constraints in mitigating and adapting to climate change. A broad and deep commitment to sustainable development can be enhanced through greater interactions among human rights, environment and trade communities. International environmental and human rights lawmaking increasingly occurs through consensus building forums that draw upon the insights of a wide array of stakeholders. Energy, water, climate, human rights, trade, armed conflict, and international organizational law are e-merging (merging and emerging) into a powerful collaboration to address core challenges. Spheres of law and policy are increasingly overlapping in ways that provide opportunities for synergies. Network coordination can further international organization and non–state actor involvement in transboundary deliberative decision-making.

- The Green Climate Fund, government EST R&D and diffusion grants, tax credits and other policy incentives can enhance public-private catalytic funding. Linking these efforts to country compliance to transfer technology to least developed countries set forth in TRIPS Article 66.2 could facilitate environmentally sound innovation diffusion. In particular, OECD government climate stimulus, perhaps via university partnerships, could ramp up EST diffusion efforts to least developed countries.

- Universities, individual innovators, private firms, civil society, governments, and the United Nations can bring environmentally sound innovation into widespread use to achieve sustainable development. In particular, universities can facilitate this collaboration by fostering global innovation and diffusion networks. Prizes that create a race for a new innovation should be mindful to take account of subsequent inventions building upon the initial invention. Sequential innovation should be encouraged in a manner that keeps important EST accessible to least developed countries through subsidized EST licensing or policies to keep crucial innovations in the public domain combined with prize or tax based incentives to further innovate. Future adaptive technology networks may benefit from universities, public and private developers placing innovations in public databases with sliding scale licensing arrangements based on capacity to pay, importance of the innovation to addressing climate change and degree to which the innovation relied upon publicly funded research.

- Bringing patent portfolios to the pool can perhaps be best accomplished through university laboratories willing to engage in public domain collaborative innovation and diffusion of climate technologies. International climate R&D prizes can catalyze breakthrough innovation that should then be accessible for further innovation.

- Innovative resilience involves norm building to enhance the sharing of insights among international, tribal, federal, state, local, regional, NGO, civil society groups, and individuals. Sometimes indigenous communities have the greatest expertise, while in other instances transboundary water organizations can best implement sharing water-energy-climate responsibilities. The international community has expanded and can build upon its international organizational frameworks to bridge human rights, environment, international economic energy, innovation/intellectual property, water, and climate strategies into genuine sustainability. Taking intergenerational equity, precaution, and other codified and yet to be codified general principles seriously in the collaborative governance process likely can foster inclusive innovative resilience. Gandhi's success was in his wisdom that cooperation is instrumental. Such cooperation cannot end with those already in agreement but must transcend deep cultural, economic, religious, and a range of other groupings to find shared vision and carry out shared solutions.

VI. Conclusion

This article has framed environmentally sound innovation and diffusion in the context of transnational network theory with the goal of setting forth a preliminary framework for international legal policy coherence. I have asked how intra-network dynamics can facilitate broad diffusion of environmentally sound technologies. I conclude that what appears to be fragmented trade, environment, and human rights regimes are indeed sustainable development building blocks with which to achieve good governance. The technology network can incentivize collaborative creativity, coordinate complex, interrelated international legal spheres, and evolve locally specific solutions through coordinating networks that can identify and build upon best practices.

Countries are genuinely unsure how to address climate change without strangling the short-term economic growth upon which political stability depends. Drivers for environmentally sound innovation include reducing GHG emissions and national security. Challenges to transitioning to greater efficiency and renewable energy use include the degree to which fossil fuel is deeply embedded in the economy and the degree to which putting a price on carbon is a prerequisite for substantial private sector investment in innovation and participation in diffusion.

Collaborative environmentally sound innovation networking may be able to shepherd whole renewable energy sectors across the innovation valley of death and help turn a global responsibility to ramp up green technology into a global initiative to do so. A good starting point would be for trade and environment regimes to set clear criteria for what constitutes environmentally sound innovation based upon ongoing life cycle analysis that is mindful of science and equity. Network coordination can facilitate breakthroughs in trade and environment relations and build upon best practices.